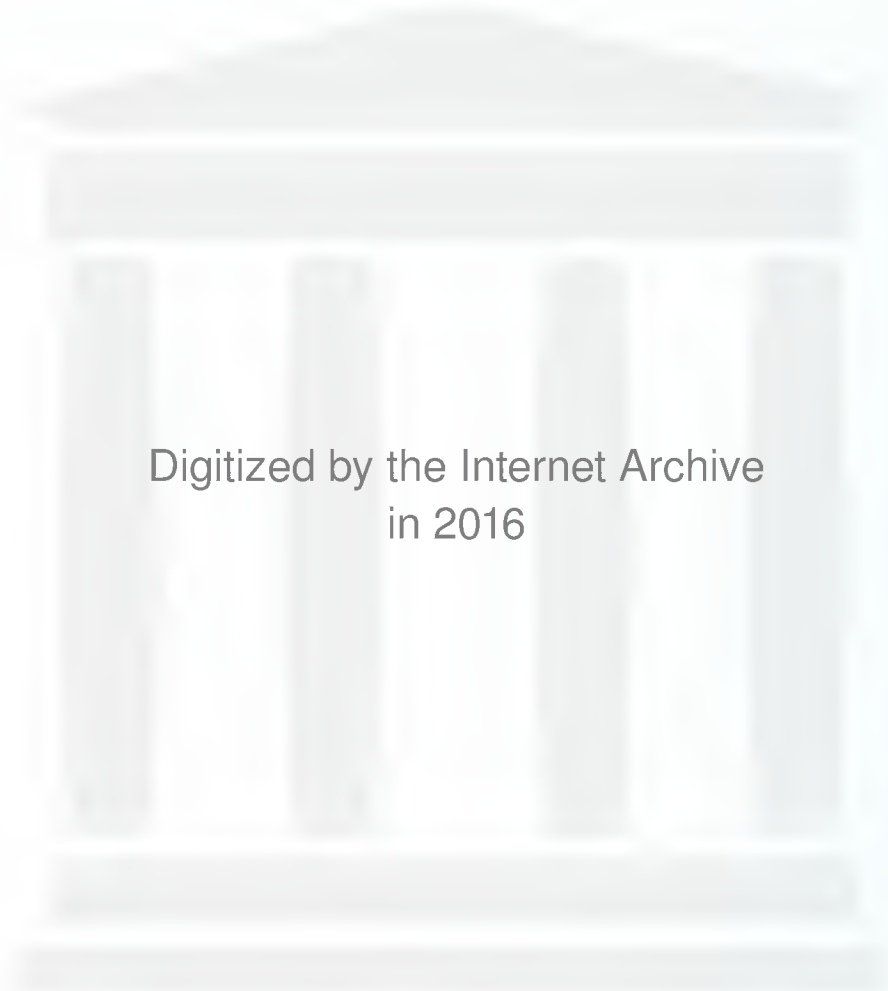
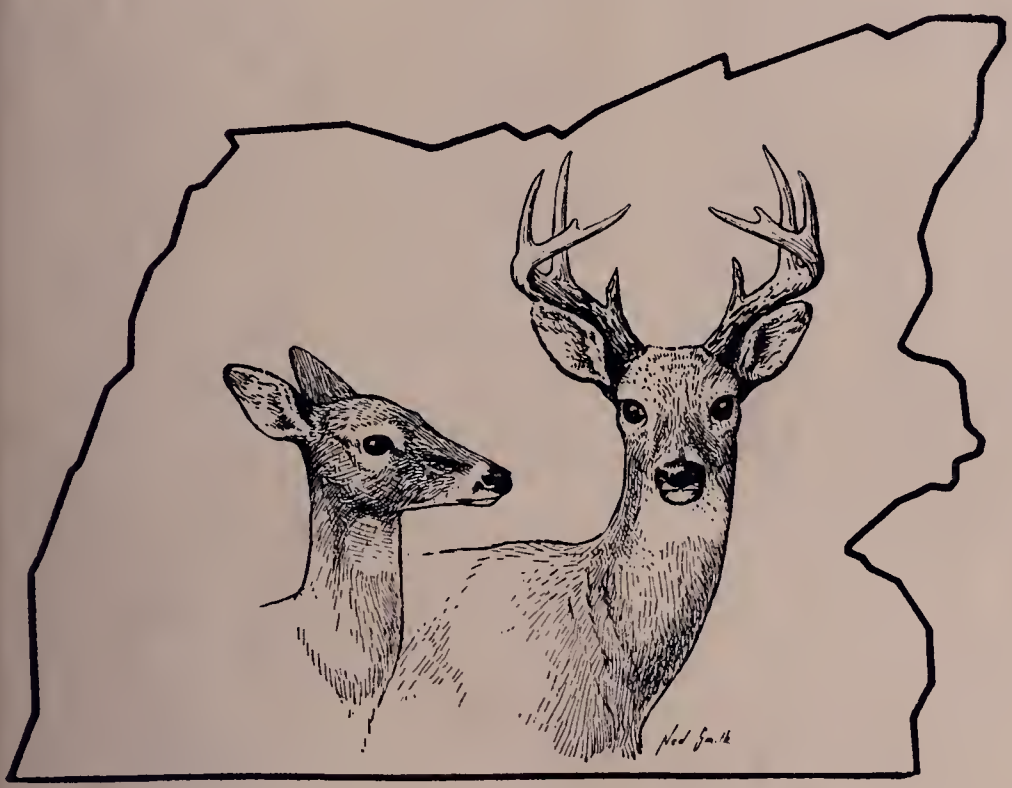


MAMMAL SURVEY

OF

South Central Pennsylvania



FINAL REPORT

PITTMAN-ROBERTSON PROJECT 38-R

COMMONWEALTH OF PENNSYLVANIA

JOHN S. FINE, *Governor*

★

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MAMMAL SURVEY

OF

South Central Pennsylvania

By

CLAY L. GIFFORD, Project Leader

AND

RALPH WHITEBREAD, Assistant Project Leader

PUBLISHED BY THE

PENNSYLVANIA GAME COMMISSION

HARRISBURG, PA.
1951

INTRODUCTION

This survey of the mammals of south central Pennsylvania is a portion of a state-wide survey to obtain practical management information about the mammals of the Commonwealth with particular reference to their life histories, ecology, range, abundance, habitat preferences, economic importance, and the effects of land use on their populations.

A study of the mammals of northwestern Pennsylvania (Pittman-Robertson Project 20-R) was completed in 1948. Mammals of southwestern Pennsylvania (Pittman-Robertson Project 24-R) was completed in 1949. Mammals of north central Pennsylvania (Pittman-Robertson Project 37-R) were studied concurrently with the present project. Surveys of the mammals of northeastern and southeastern Pennsylvania (Pittman-Robertson Projects 42-R and 43-R respectively) are in progress and will be completed June 30, 1951.

Prior to these six surveys, the only comprehensive work concerning the mammals of the Commonwealth was *The Mammals of Pennsylvania and New Jersey* by Samuel N. Rhoads, 1903. We know that changes in abundance and in distribution of mammals in the state have occurred since the time of Rhoads. It is hoped that the specimens and data gathered by this survey, as well as the information presented here, will be of value to all who are interested in our wildlife resources.

Although this report is based primarily upon the field notes of the Project Leader and Assistant Project Leader, everyone associated with the project has contributed much in the way of information and suggestions. However, the responsibility for the information included here, and the interpretations given it, must be borne by the writers, Clay L. Gifford, Project Leader, Ralph Whitebread, Assistant Project Leader, and Neil D. Richmond, Project Field Supervisor.

Editor's Note: In order to present this report in a length and treatment comparable to the other three sectional reports, it was necessary to shorten, and in some cases, revise the original manuscript submitted by the Project Leader. This was done by Neil D. Richmond, Project Field Supervisor.

ACKNOWLEDGMENTS

The Survey of Pennsylvania Mammals (south central sector) Pittman-Robertson Project 38-R, was conducted under the Federal Aid to Wildlife Restoration Act of 1937, and was administered jointly by the Pennsylvania Game Commission and the United States Fish and Wildlife Service.

The Survey of Pennsylvania Mammals was inaugurated through the efforts of Hon. Ross L. Leffler, President of the Pennsylvania Game Commission and Dr. J. Kenneth Doutt, Curator of Mammals, Carnegie Museum, Pittsburgh, Pennsylvania. The work of the survey was planned and initially supervised by Dr. Doutt in his capacity as Super-

visor, Special Personnel. He was also responsible for the taxonomic studies involved.

Neil D. Richmond, Field Supervisor, was responsible for the planning, supervision, and coordination of the field work with that of the other three parties.

Robert D. McDowell, Chief, Wildlife Research Division, Pennsylvania Game Commission, directed the project.

Miss Caroline A. Heppenstall, Assistant Curator of Mammals, Carnegie Museum, Pittsburgh, Pennsylvania, aided in the identification of the specimens, and was responsible for the many details involved in receiving, handling, and caring for the collection of mammals and information as they were sent in from the field.

Lorenzo B. Pryor, Research Assistant, Wildlife Research Division, Pennsylvania Game Commission, executed many details of administration for the project, and gave much help in the assembling of data from Game Commission records and other sources.

The following part-time assistants have worked for various lengths of time on the preparation of the skeletal material, food habit studies, and typing: Miss Aenid Horton, Miss Margaret MacGregor, Miss LaVerne D. Mowry, John E. Guilday, Donald Mears, and A. C. Lloyd.

In addition, we wish to thank the following organizations and individuals:

The Pennsylvania Department of Internal Affairs, Topographic and Geologic Survey, for permission to use their map showing the physiographic divisions of Pennsylvania.

The United State Department of Interior, Fish and Wildlife Service, for their services and publications.

The Pennsylvania Department of Agriculture for data on land use.

The United States Department of Agriculture for soil publications.

The several offices of the Pennsylvania Game Commission for data from their records.

Colonel Robert L. Daniels, Commanding Officer, Letterkenny Ordnance Depot, and the personnel of his command, for permission to carry on our work there, and for giving us every possible assistance.

Dr. Earl L. Poole, Director, Reading Public Museum, for showing us records and mammal specimens there, and answering our questions about mammals in southeastern Pennsylvania.

Dr. P. F. English, and Dr. Ward M. Sharp of the Pennsylvania Cooperative Wildlife Research Unit, Pennsylvania State College, for interest, suggestions, and for showing us mammal specimens in the unit collection at State College.

The members of the various sections of Botany and Zoology in Carnegie Museum, Pittsburgh, for their cooperation in helping us to identify plant and animal remains for our food studies.

Roger Latham, for aid to our field work in Huntingdon County, for owl pellets collected in Franklin County, and for several specimens and distribution records.

Mr. Arthur G. Logue, Division Supervisor, and the District Game Protectors of the South Central Wildlife Conservation Division, Pennsylvania Game Commission, for their interest and cooperation in saving specimens, giving us information, and helping us to find housing throughout the area. District Game Protector Daniel Faekler, of York County, in the Southeast Wildlife Conservation Division was also helpful to us.

The many trappers, fur buyers, sportsmen, and landowners, for their information, specimens and general interest.

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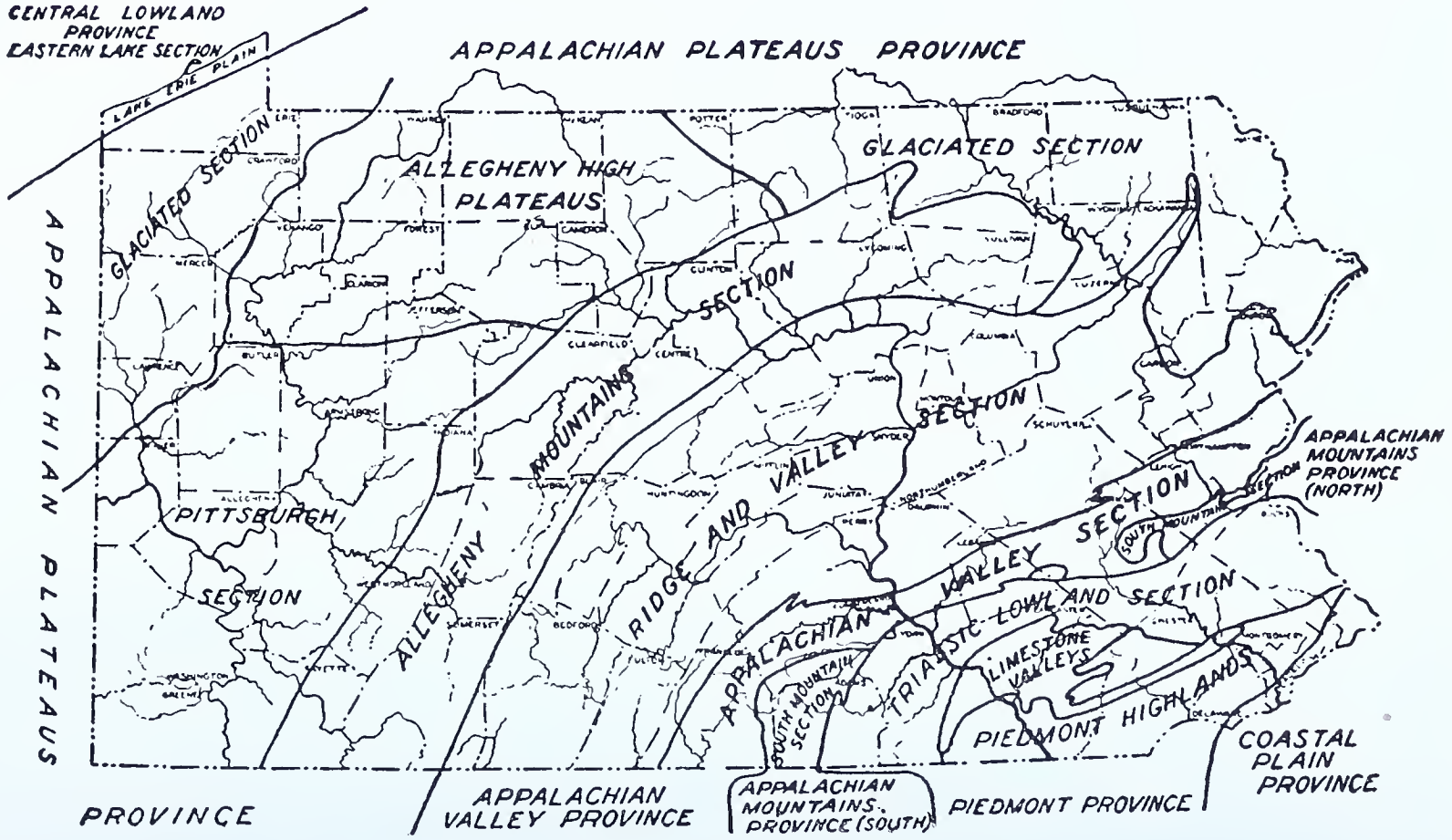


FIG. 1. PHYSIOGRAPHIC DIVISIONS OF PENNSYLVANIA

DESCRIPTION OF THE STUDY AREA

EXTENT

The area covered by this survey includes that portion of Pennsylvania west of the Allegheny Front, south of Centre and Snyder counties, and west of the Susquehanna River. It covers an area of 6,946 square miles, and includes the following counties in their entirety: Adams, Bedford, Blair, Cumberland, Franklin, Fulton, Huntingdon, Juniata, Mifflin, Perry, and York.

There is a maximum difference in elevation of 3,066 feet between the Susquehanna River at the Maryland line in York County, at about 70 feet, and the crest of Blue Knob, an outlying peak from the Allegheny Mountain in Bedford County, at 3,136 feet. The following table shows area and maximum relief by county:

AREA AND MAXIMUM RELIEF BY COUNTY

County	*Area*	*Highest Point*	*Lowest Point*	*Maximum Relief*
Adams	528 sq. mi.	2,200 ft.	900 ft.	1,300 ft.
Bedford	1,026 "	3,136 "	740 "	2,396 "
Blair	535 "	3,000 "	720 "	1,280 "
Cumberland	528 "	2,080 "	291 "	1,789 "
Franklin	751 "	2,440 "	600 "	1,840 "
Fulton	403 "	2,440 "	420 "	2,020 "
Huntingdon	918 "	2,400 "	520 "	1,880 "
Juniata	392 "	2,260 "	380 "	1,880 "
Mifflin	398 "	2,340 "	430 "	1,910 "
Perry	564 "	2,240 "	310 "	1,930 "
York	903 "	1,240 "	70 "	1,170 "

PHYSIOGRAPHY

Figure 1 shows the physiographic divisions of Pennsylvania. Our sector contains the most varied physiography and topography to be found in the state. It includes parts of three physiographic provinces usually divided into six physiographic sections. Each physiographic section has its typical appearance and topography.

The western boundary of our sector is formed by the Allegheny Escarpment or "Front" which rises, like a wall, along the western edge of Blair and Bedford Counties. It divides the Ridge and Valley Section from the Allegheny Mountain Section of Western Pennsylvania with its higher ridges and high inter-mountain plateaus. Throughout this sector, the Front constitutes the divide between Atlantic and Mississippi drainage systems in western Pennsylvania.

The Ridge and Valley Section is characterized by long, narrow, parallel, even-crested, forest-covered ridges with broad, nearly level to hilly, farmed lowlands between. The general direction of the ridges is northeast, bending ever more eastward as they proceed northward until, at the northeast corner of this sector, they run almost due east. These ridges were formed by a strong upbending of sedimentary rock strata. The mountains follow the direction of these folds. They are capped with hard resistant strata of sandstones. The valleys are formed on softer underlying strata less resistant to erosion. The rock strata which compose the mountains are usually turned up at steep angles, often much bent, and hardened in varying degrees by the forces involved. Little

soil has accumulated on the mountains, and, in many places, almost uninterrupted talus slopes of Tuscarora "Quartzite," a hard, whitish, cemented sandstone, extend for miles. This stone caps most of the main mountain ridges of the Ridge and Valley Section. The bare to thinly wooded talus slopes are a distinctive mammal habitat in this sector, severe in climate, and limited in the amount of surface water and in the variety of food. On a greater area of these ridges, some soil has accumulated and forests cover the rock, but soil and vegetation still reflect its character.

Topography of the lower lands between ridges varies. Devonian shale lands occupy the greatest area, and support a characteristic gently rolling to moderately hilly topography, interrupted by low ridges usually formed on sandstones softer than the Tuscarora Quartzite. Elsewhere, limestone topography occurs with near-level to gently rolling land not oriented to its surface streams and dotted with sink holes. These inter-mountain valleys vary considerably in elevation. The land in some western valleys averages 1000 to 1200 feet as compared with 400 to 500 foot elevations farther east.

Within the Ridge and Valley Section there is one considerable area atypical in topography and geology. This is the Broad Top Mountain region of northeast Bedford and adjoining counties. It is essentially a broad mountain top plateau, formed on Mississippian and Pennsylvanian strata and supported by Pocono sandstones. In geology and topography it resembles areas west of the Allegheny Front. The Pocono sandstone is softer than the Tuscarora Quartzite. It forms a softer soil more abundantly, and appears to affect even the vegetation which has a general aspect more similar to western Pennsylvania than to the surrounding lands. Rocky areas occur, but the steep talus slopes are practically absent. This Pocono Formation extends south from Broad Top Mountain and forms Town Hill, Ray's Hill, and Sideling Hill, which all retain this same aspect so different from surrounding mountain ridges.

South and east of the Ridge and Valley Section, the Appalachian Valley presents a sharply different aspect. Its near-level to gently rolling farmland is underlain on the west side by Martinsburg Shale and on the east side by limestones. This valley, ten to twenty miles wide, enters this sector from Maryland and Virginia. In the north, it swings east across the end of South Mountain to the Susquehanna River, and on across Pennsylvania into New Jersey. It is also known as the Cumberland Valley, or Great Valley, and by several other names in other states. It is not a stream valley, but rather a structural valley, since most of its streams flow across, rather than through it.

The South Mountain Section enters this area from Maryland, rising sharply between the Appalachian Valley and the Triassic Lowlands. Its north end stops abruptly against the Appalachian Valley south of Carlisle. This section is a jumbled mass of low peaks, spurs, and short, deep valleys quite different in appearance from the parallel, even ridges of the Ridge and Valley Section. It is formed on sedimentary, igneous and metamorphic rocks, most of them hard and massive. The Weverton Sandstone makes few talus slopes but many areas of large sandstone

blocks. The region is almost too stony to farm. It does provide a large block of undisturbed forest for wildlife with better distribution of surface streams than the mountains of the Ridge and Valley Section.

The Triassic Lowlands are formed on soft red shales and sandstone deposited in a basin here during the Triassic Period. Topography and use are similar to the Appalachian Valley with level or gently rolling farmlands, and low, rounded hills. A narrow corridor of igneous rocks extends through the center of the area, forming low hills which are too rocky to farm but are used for pasture, woodlots, or are in brush. The Pigeon Hills, small isolated peaks of igneous and metamorphic rock, rise in the southeast of this section. Together with some lower hills, they separate the Triassic Lowlands from the broad, level Limestone Valleys Section which runs from Hanover, past York, to the Susquehanna.

South and east of the Limestone Valleys, the land rises again in a region of rounded, flat-topped hills developed principally on schists, and some other metamorphic rocks. This is the Piedmont Highlands Section. It provides good farming, but supports wooded areas along the steep valleys of small streams, and the steep banks of the Susquehanna, where block areas of quartzite occur.

DRAINAGE

The western boundary of this sector follows the Allegheny Front which is the divide between the Mississippi drainage in southwestern Pennsylvania and the Atlantic drainage in this sector. All streams in our sector drain directly, or indirectly, into two rivers—the Susquehanna and the Potomac. About one-fourth of this sector, in the southern tier of counties, is drained by small streams flowing south to the Potomac. The Potomac drainage system reaches farthest north in Franklin County at the headwaters of the Conococheague Creek, and drains most of that county. The drainage divide is a wandering line and follows no mountain ridge for any great distance, but rather tends to cross the ridges. In some places, as at Martin Hill in Bedford County, it may cross a peak. At other places it follows along the crests of low inter-mountain hills undistinguished by elevation. In many places, adjoining parallel valleys are drained in opposite directions—one toward the Potomac, the other toward the Susquehanna. Extreme interlocking of drainage systems is most conspicuous in northwestern Franklin County. York County has only two small streams, near Stewartstown, which drain to the Potomac.

Most of the Ridge and Valley Section drains north and east to the Juniata River, and tributaries into the Susquehanna in Perry County. All the major streams of the Ridge and Valley Section have high, rocky cliffs and steep banks along much of their courses. They are extensively forested and little disturbed and provide excellent range, near water, for game and furbearers. All rise in cool, rocky, mountain trout streams. Although their rate of flow decreases and their temperature increases as they increase in size, all maintain a fair rate of flow throughout the summer. During periods of heavy rainfall, they rise rapidly, sometimes to flood levels. Most are fairly stony throughout. Their banks support the greatest variety of vegetation found in this sector.

Cumberland, York, and northern Adams Counties drain almost entirely into the Susquehanna. Conodoguinet Creek rises in the easternmost ridges of the Ridge and Valley Section. Yellow Breeches Creek rises in the South Mountain Section. Both start as trout streams but become slow, muddy, deep and very crooked as they pass through the lowlands.

The Triassic Lowlands of northern and eastern Adams County and northern York County are drained eastward by Conewago Creek, an extremely meandering, slow stream. Codorus Creek drains the Limestone Valley Section of York County. Muddy Creek drains the Piedmont Highlands.

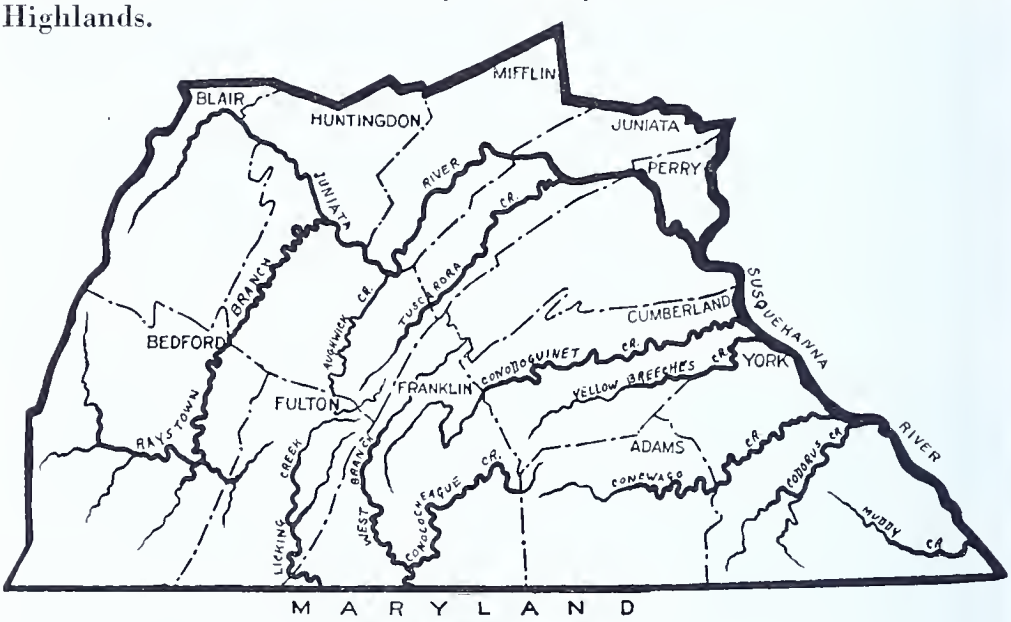


FIGURE 2. Drainage Pattern in South Central Pennsylvania.

SOIL TYPES

Major soil groups coincide with the physiographic and geologic divisions of the sector. For example, the Ridge and Valley Section is principally a region of lithosols (shallow, stony soils). Physiographic sections east of it are occupied by grey-brown podzolic soils. In addition, individual soil types often follow outcroppings of certain geologic formations quite closely. Each soil type usually has a rather constant relation to local topography—that is, it will be characteristic of valleys, of mountain flanks, of shale hills, etc.

In this sector, soil types are numerous and intimately mingled geographically. To simplify this account, we have combined certain soil groups, as described in published soil surveys, into soil areas of wide geographic extent in our sector. The result is an over-generalization for purposes of simplicity. For more detailed information, see U. S. Department of Agriculture Yearbook (1938), Shaw (1914) or the various county soil reports.

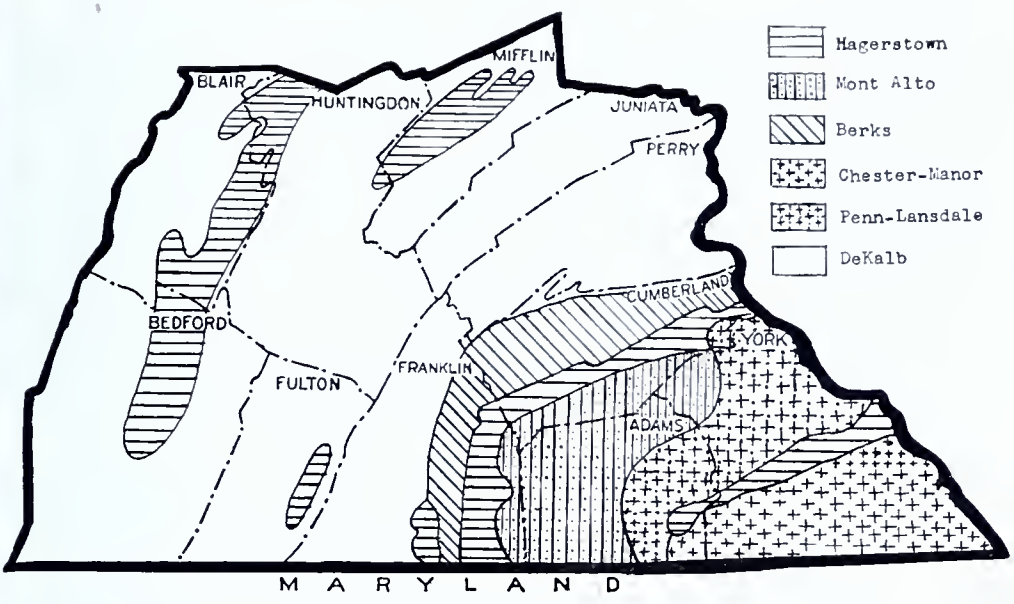


FIGURE 3. Major Soil Types.

Finally, it should be remembered that, within any broad expanse of a certain soil type as mapped by a large scale soil survey, there are many smaller areas with soil conditions of their own. These are often neglected or abandoned areas too steep, too wet, too rocky, or too dry to farm. Such areas are often more important to wildlife than surrounding farmed areas of typical soil, in providing food, cover, and relative freedom from disturbance.

De Kalb Area: This includes the Muskingum-Lehew and Upshur-Muskingum areas, as mapped in the Yearbook (1938), and the DeKalb-Morrison-Egemont-Upshur areas of Shaw (1914). These soils are stony, shallow soils (lithosols) occupying most of the Ridge and Valley Section. They are formed principally on the widespread shales and sandstones of the section. Types vary considerably in appearance and texture. They are usually well to excessively drained, especially on the shale hills. Locally, particularly where they lie over limestones, they may be so excessively drained as to form "barrens" too subject to drought for farming. As a group, they are usually deficient in organic matter and almost always in lime. In many localities, it seems to us, they support wild vegetation in less variety, and often in less abundance, than do soils in equivalent topographic situations in many other sections of the state. Farmland on these soils varies widely in value, but is almost always well below Hagerstown soils in productivity, and usually below the other soil groups in this sector. Land use ranges from intensive farming to widespread abandonment. Much of the forest land was never farmed.

Hagerstown Area: This includes Hagerstown-Frederick (U. S. D. A. Yearbook, 1938) and Hagerstown-Conestoga-Frankstown, Duffield (Shaw, 1914). These fertile soils occupy the southeastern half of the Cumberland Valley, the Limestone Valley Section of York County, and the great valley between Dunning Mountain and Tussey Mountain.

Smaller areas occur through the Ridge and Valley Section, including Kishacoquillas Valley, Blacklog Valley, and others. In addition to these areas formed on Trenton limestones, there are small scattered local areas formed on low ridge outcrops of the Lower Helderberg Formation.

These soils range in color from brown through a peculiar orange to reddish. They are composed principally of residue from limestones removed by solution. They are often deep and are dominantly silt loams and clay loams in texture. Drainage and moisture-holding properties are usually good, and they are little subject to erosion. They contain fair amounts of organic matter and mineral plant nutrients. Much of the original lime has been leached out. The addition of lime by farmers is a common practice. They are considered the most productive and valuable farm soils in the state, and are intensively farmed.

Berks Area: Includes Berks (Shaw, 1914), included in Muskingum-Lehew (U. S. D. A., 1938). Berks soils occupy the northwestern half of the Appalachian Valley in a band between the first mountain ridge and the limestone lands. Small local areas occur on the flanks of limestone lands elsewhere in the sector. They are formed on shales, shaly sandstones, and slates, particularly the Martinsburg Shale, which they follow closely in distribution. They vary in color from brown to gray, rarely reddish. Shale loam is the dominant texture type. Drainage is good to somewhat excessive, except in low spots. Moisture-holding properties are fair to poor. Most soils are light and easily worked. They are usually rather shallow, but rest on rapidly weathering rocks. Erosion is severe throughout. They are deficient in organic matter. These soils range in value from one-half to two-thirds that of the adjacent limestone lands, and are usually intensively farmed.

Mont Alto Area: Includes Mont Alto-Porters-Murrill (Shaw, 1914) included in Chester Manor (U. S. D. A., 1938). As shown in our map *(Figure 3)*, it includes an area mapped by Shaw as DeKalb. These soils occupy the South Mountain Section and its flanks, also a narrow corridor, following igneous outcrops out into the center of the Triassic Lowlands Section, not shown on our map. They are formed on igneous and metamorphic rocks, or principally from these materials as outwash over limestones at the mountain foot. They are mainly red, reddish-brown, or grayish-red. Stony loam is the most extensive type. Some are sticky when wet, but crumble readily when dry. They are normally well drained and have good moisture-holding properties. Farmland on these soils ranges rather widely in value, partly because of its topography. Apples and peaches grow particularly well on these soils.

Penn-Lansdale Area: Includes Penn-Lansdale (Shaw, 1914) (U. S. D. A., 1938). As shown on our map *(Figure 3)* it includes a small area mapped by Shaw as Mont Alto. These soils occupy the Triassic Lowlands Section. They are formed on shales and sandstones, principally the red Triassic formations of this section. They range in color from red through brown to dirty gray. Silt loam is the leading type, but loam is extensive. On level areas these soils are often poorly drained. Erosion is moderate on slopes. Moisture-holding properties are believed to be fair. These soils are deficient in organic matter and uniformly in

need of lime. They are productive farm soils, closely farmed, but average somewhat below the Hagerstown and Chester-Manor groups in value.

Chester-Manor Area: Includes Chester-Manor Area (Shaw, 1914) (U. S. D. A., 1938). These soils occupy the Piedmont Highlands of York County in this sector. They are formed on the underlying schists so dominant in this region and to a lesser extent on gneiss and igneous rocks. They are usually yellowish-brown to brown. Loam and stony loam are the most extensive types. Mica flakes are often present, sometimes abundant. These soils are well drained. Chester soils have a very good moisture-holding ability. Manor soils have only fair moisture-holding ability and, where they are very micaceous, they are subject to drought. Both are rather highly subject to erosion. Chester soils are naturally productive and better than Manor soils. Both benefit by addition of organic matter and lime. Both soils are closely farmed. Chester soils are usually less valuable than Hagerstown soils, but are better than Penn-Lansdale.

CLIMATE

The climate of south central Pennsylvania shows the effect of the varied physiography of the section. If one proceeds from the extreme southeast corner, either northward or westward, approximately the same changes in climate will be observed. The following table shows the differences in the average climates of five stations of approximately the same latitude in southern Pennsylvania. Holtwood, on the Susquehanna River, and Somerset, on the Allegheny Plateau, show the two extremes. Most of the area north and west of the Blue Mountain has climatic averages in between those shown for Holtwood and Somerset.

Station	County	Killing Frost—av. date: Last–Spring		First–Fall		Growing Season Days	Av. Annual Precip. Inches	Mean Temp. Jan.	Mean Temp. July	Elevation Feet
Holtwood	Lancaster	Apr.	12	Nov.	3	205	36.20	32.1	77.1	200
Hanover	York	Apr.	26	Oct.	16	173	40.07	33.1	75.8	600
Everett	Franklin	May	2	Oct.	11	162	39.79	30.4	75.0	640
Chambersburg	Bedford	May	9	Oct.	4	148	38.49	28.1	71.6	1020
Somerset	Somerset	May	19	Sept.	27	131	50.93	27.1	68.7	2140

One interesting climatic feature in this section is the area of low annual precipitation immediately east of the highest portion of the Allegheny Mountains. This area includes most of Bedford County and part of Fulton County. It averages 10 to 14 inches less precipitation than the plateau twenty miles to the west.

In the Ridge and Valley Province there is considerable local variation in temperature extremes, amounts of snowfall, and distribution of precipitation. One feature observed to have a marked effect on vegetation was the high frequency of ice storms along the ridges.

NATIVE VEGETATION

The vegetation of south central Pennsylvania is strongly modified by the physical structure of the section with its diversity of exposures, soil types, and amount of soil moisture. The effects of land-use are notable here in the virtual elimination of forests from the fertile soils of the Cumberland Valley, the Triassic Lowlands, and all of the limestone valleys.

This entire section is within the region of the southern hardwoods (Oak Type) forest. However, there are small areas along the higher ridges where outliers of the northern hardwood (Beech-Birch-Maple-Hemlock) forest occur.

Forests agreeing in general description with the Beech-Birch-Maple-Hemlock Forest Association occur in Cambria County, but, on descending the Allegheny Front, beech drops out of the forest and wild cherry becomes scarce. Beech is scarce and localized in most of this section, and wild cherry as a component of Birch-Hemlock forest is of minor importance. The Hemlock Forest Association occurs principally along the northern border of this section from about the latitude of Lewistown. White pine and hemlock are prominent components of forests in the stonier and more shaded sites in the entire northern third of this sector. Throughout the greater part of our section south of this, forest areas containing much hemlock become increasingly less common and more localized, and are restricted to moist north exposures on the mountains and to ravines. Extensive areas of hemlock, with a variety of other hardwoods and an understory of rhododendron, striped maple and witch hazel, occur along mountain streams in the South Mountain section.

By far the greatest part of our forests are dominated by oaks; even the Pitch Pine Association usually has more combined oaks than pitch pine. Chestnut oak is its commonest tree associate with scrub oak *(Quercus ilicifolia)*, laurel, various huckleberries, and sweet fern forming an understory. On some sites, such as the "Barrens" in northern Huntingdon County and on many of the drier ridges, repeated burning has produced an association in which scrub oak is dominant and pitch pine is more scattered. Dry mountain tops are often occupied by a Chestnut Oak Association with red and black oaks and red maple common associates. This forest type is often open and park-like, too dry for close growth or dense ground cover. It is best developed on the south and east faces of mountain crests in this section. It can best be seen in large areas in the Seven Mountains, but is common on mountains throughout this section. This and the Red Oak-Black Oak-Chestnut Association cover most mountain sides, with the latter association occurring on lower slopes.

A White Oak Forest Association or an Oak-Hickory Forest probably occurred on the hills between mountains in this section, but it is difficult to form any idea of its nature since forests of these types grew on soils suited to agriculture and were removed by the early settlers. White oak is a common, but not a dominant, tree in many of the remaining forests. This association may have occurred in the Cumberland Valley

and in Adams County before settlement, but present woodlots there are on sites of atypical soils and exposures and it is difficult to form any idea of original conditions.

The forests of the steep hillsides along the Susquehanna and its tributaries appear the most variable in composition and the richest in variety of shrubs and herbaceous plants.

Comparison of characteristic stages of succession in this section with those in other parts of Pennsylvania shows interesting differences. On the limestone soils here, black locust is most prominent in invasion of both abandoned fields and pastures with ash and elm common on moister sites. On the Devonian shale lands through the Ridge and Valley Section, Virginia pine and pitch pine are the dominant invading trees over wide areas. They come into both abandoned crop land and pastures. The abandoned pasture thickets of hawthorne or cherry common in northwestern Pennsylvania, and the old fields of crabapple common in southwestern Pennsylvania, are largely replaced in this section by these associations, and by cedar thickets in the Triassic Lowlands and Piedmont Highland sections.

LAND USE

The dominant role played by land-use in mammal ecology is too well recognized to need repeating here. Relationships, such as the effect of forest clearing on grassland and forest species and the extermination of large wilderness forms incompatible with intensive farming, are often obvious. However, the reaction of each species to different farming practices and to various successional stages following abandonment is not well known. It is a promising field for intensive, long-term studies.

Most of our small game and furbearing mammals appear to benefit from farming and to thrive on and near farmlands wherever sufficient cover exists. Cropfields, pastures, orchards, meadows, brushy fencerows, and small neglected areas usually provide abundant food, but a place of refuge from disturbance is also necessary. Early successional stages following abandonment with lush growth of grasses and weeds, and later stages with abundant berries, fruits, and shrubs, usually support many mammals. Occasionally, as at Letterkenny Ordnance Depot, abandonment of good farmland may be followed by striking increases in mammal populations. Groundhogs, rabbits, foxes, and probably other species as well, all increased after farm abandonment there.

Among the smaller mammals, reaction to agriculture varies. Some species, such as the wood rat; red-backed mouse; gray, long-tailed shrew; and cloudland deer mouse, appear restricted in this sector to habitats never farmed. Others, such as the meadow mouse, prairie deer mouse, short-tailed shrew, white-footed mouse, house mouse (and in some areas, the pine mouse) have adapted themselves well to farmland, moving in to feed and even to breed in the cropfields, hayfields, and pastures between plowings and mowings. Even these mammals are discouraged by too close pasturing or too clean farming, however. They usually thrive better in small, neglected or recently abandoned, areas. Some forms, such as the lemming mouse, pine mouse, masked shrew, and probably

the jumping mice and the moles, appear to thrive better in abandoned farmland long undisturbed and beginning to revert to forest. In comparing populations of forest and farm, it is well to remember that the soil fertility in any region is usually highest in the farmland. Abandoned areas are usually deficient in fertility and water, and areas totally unfit for farming are usually left in forest. These facts tend to obscure the relations between land-use and mammal populations.

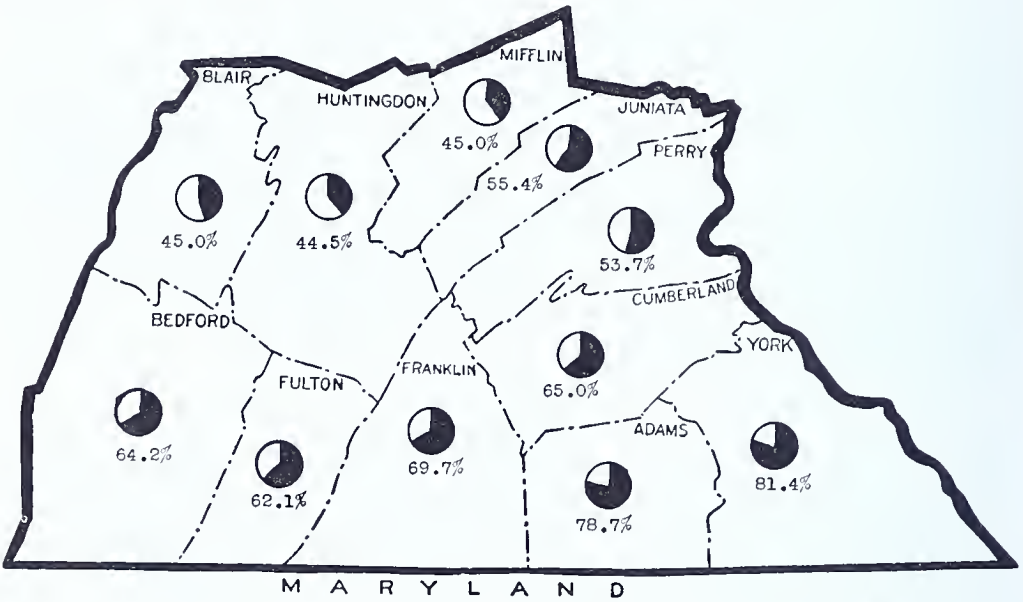


FIGURE 4. Distribution of Farming in South Central Pennsylvania. Black Portion Indicates Percentage of County in Farm Land.
(U. S. Dept. of Agric. Census, 1945)

Although this sector supports some manufacturing, mining and quarrying, and a good amount of lumbering, it is primarily an agricultural region. General farming dominates throughout. Fruit growing is important in parts of the Cumberland Valley and the South Mountain regions. Dairy farming is important locally in several places, notably York County and the limestone regions in general. Census figures seem to indicate no obviously strong trends toward changes in farming practice since 1920. About eight per cent of the total area has reverted from farmed to unfarmed land during the period from 1920 to 1945. Franklin County has the highest rate of abandonment, about fourteen per cent. Blair County, with two per cent loss in the same period, has the least. The greatest period of land abandonment in the Ridge and Valley Section appears to have occurred between 1900 and 1920.

This sector falls naturally into two areas with regard to land use: the four southeastern counties, and the seven counties of the Ridge and Valley Section. The southeastern section has more than twice as much cleared land as it has forested land. York County leads with more than three times as much land cleared. The Ridge and Valley Section, however, has more than half again as much forest as cleared land. Huntingdon County leads, with more than two and one-half times as much forest as clearing *(Figure 4)*.

The southeastern area has almost four-fifths of its land in farms while the Ridge and Valley area has a little over half in farms. The southeastern area averages a little better than half again as much acreage of farmland per county as the Ridge and Valley area, but on this they produce an average of four times as much wheat, three times as much corn, half again as much oats, and twice as many cattle and sheep per county as the Ridge and Valley area. This difference in productivity reflects the better topography and the deeper, more fertile soils of the southeastern counties (See *Soil Types*).

The principal grain crops of this sector are winter wheat, corn, and oats. Buckwheat, potatoes, and truck crops are locally important. In the Appalachian Valley and in York County large numbers of poultry are raised. Production of hogs and horses is moderate to low. As a stock-raising region, this sector falls somewhat below the counties of southwestern Pennsylvania.

The relatively low production of cattle and sheep in the Ridge and Valley Section is probably related to two factors. First, in much of this topography, land is either valley land or mountainside. Valley land is often rather closely farmed and too valuable as plowland for pasture use, except sometimes as dairy pasture. Secondly, where hilly land and rocky soils exist, the nature of the soil and underlying strata is often such as to produce relatively poor pasture that is subject to drought (See *Soil Types*). This pattern probably affects wild mammal populations also. The neglected upland pasture habitat, with lush grass, herbaceous weeds, food-bearing shrubs, and briar thickets, offers food and cover with little disturbance. It is common elsewhere in the state, but all too often here old pasture is replaced with a thin growth of poor grasses, a rapidly growing thicket of scrub pine, and little else. On shale land especially, scrub pine is the dominant invasion tree, both on abandoned pasture and cropland. It appears to offer most mammals little except shelter. Thus the Ridge and Valley topography seems to accentuate a habitat problem present elsewhere, although less marked—that is, mammals have to live either in closely farmed lowlands with sufficient soil fertility, food and water, but constantly disturbed and deficient in cover; or on rocky mountainsides in habitats undisturbed, but deficient in soil, water, fertility, and often food. Intermediate situations, frequently productive of wildlife elsewhere, are here limited in area.

In addition to agriculture, quarrying is one of the most widespread industries. "Gannister" (Tuscarora Quartzite) is quarried in many places on the mountains for fire brick. Glass sand is more localized. Slate and "Green Marble" are important in York County. Limestone, for all uses, is quarried in many places throughout the sector. Ecological effects of these operations are seldom clear beyond the fact that they support a local hunting population in addition to that supported by the farms. The same is true of manufacturing, which in this sector, centers mainly about York, Hanover, Carlisle, Waynesboro, Chambersburg, Lewistown, and Altoona.

Coal mining is entirely confined to a small region at the junction of Bedford, Huntingdon and Fulton counties. This is the Broad Top coal

field. Coal is removed by both stripping and shaft mining. Large areas of abandoned farmland exist in this region, and mining influences timber cutting in nearby areas by providing a market for mine props. However, paper mills at Tyrone, Roaring Spring, and other locations through the mountains do more to encourage the steady cutting of small timber. On private lands, as elsewhere in the state, mature saw timber is becoming scarce, and exists only in small stands. The extensive state-owned forests on the mountains are, in many places, coming into good stands of oak, some soon old enough to produce much saw timber.

The Ridge and Valley Province offers some of the most beautiful scenery in the entire state. This area, with its extensive forests, numerous mountain streams, and central location, is potentially important for recreation. To a more limited degree, the same is true of the South Mountains.

ECOLOGICAL DISTRIBUTION OF MAMMALS

The part of this sector that lies south and east of Blue Mountain would properly be considered as part of the Carolinian Biotic Province of Dice (1943) while the areas along the Allegheny Front and part of the Seven Mountains area in northern Huntingdon County are most like the southern portion of the Canadian Biotic Province of Dice. However, the Ridge and Valley section generally is difficult to assign to either of these broad classes. Although it has many of the features of a transitional zone between the two biotic provinces, it is also an area where the distribution of plants and animals is strongly influenced by the local and varied topography and soils, with the result that the distribution of many of the plants and animals found in this area appear to be primarily determined by the availability of suitable habitats. No groups of mammals were found that could be classed as either northern or southern. For the most part, the mammals that occur together in any one locality here are determined by the availability of suitable habitats and the adaptability of the species.

In south central Pennsylvania there are four distinct mammalian habitats: forest, field, shoreline and talus slopes. Although each of these habitats is extensive and well distributed throughout the area, no one of them exists in a sufficiently large and unbroken tract as to restrict the distribution of any of the larger mammals. To a wide-ranging animal like the deer or fox, the entire area might be considered forest edge. Of the mammals that do not range far, many are so tolerant of a wide variety of conditions that they show no marked habitat preference. Notable among these are the short-tailed shrew *(Blarina)*, woodchuck, and cottontail rabbit. With these forms, the type of habitat may influence the population density but not the distribution.

The moles, living almost entirely beneath the surface of the soil, are little affected by the vegetation above them, but are more dependent upon soils suitable for burrowing. The star-nosed mole *(Condylura)* requires moist to saturated soils, and the other two moles *(Scalopus* and *Parascalops)* require loose, friable soils.

The mammals most restricted to one habitat are those that live along the edge of water—the muskrat, otter, beaver, and water shrew. Although each of these may at times range away from water, they cannot remain there and become established.

In this section the talus slopes form a large, extensive habitat. Two species seem restricted to it—the cliff rat *(Neotoma)* and the shrew *(Sorex dispar)*. Other species that are not restricted to talus slopes but find them an optimum habitat are deer mice *(Peromyscus leucopus)* and red-backed mice *(Clethrionomys)*.

The field or grassland habitat in Pennsylvania is occupied by an association of species of which the little short-tailed shrew *(Cryptotis)*, the Maryland shrew *(Sorex c. fontinalis)*, and the prairie deer mouse *(P.m. bairdii)* seem restricted to grassland. The meadow mouse *(Microtus)* and the lemming mouse *(Synaptomys)*, both of which feed largely on grasses and today are most abundant in fields, are able to live in the small grassy openings in forests. The other common mammals in fields, the woodchuck, rabbit, and skunk, are animals that also live in forests but they find man-made grasslands even more suitable.

Since most of the section was originally covered by forest, it is not surprising that his habitat has the largest number of species adapted to it, and that the most abundant of the animals that today live in fields are those that can also live in forests or in small grassy openings in forest.

METHODS AND PROCEDURES

Field work was started in this section in November, 1948 and was completed in October, 1950. In general, the methods and procedures established by the two preceding projects (PR-20R and PR-24R) were followed.

Eleven areas were chosen for detailed study and were selected to cover the sector geographically and to be representative of as many of the major habitats as possible. In each of these eleven areas, several localities representative of both major habitats and those of special interest from the standpoint of ecology or distribution were studied and trapped. Detailed records of each locality and trapline were kept.

Additional information was obtained through interviews with local residents, trappers and hunters.

Considerable miscellaneous observations were recorded in field notes.

During the winter months two studies were undertaken to measure the effects of land abandonment on animal populations. The two areas selected are especially well suited to such studies as each has had a large tract retired from agriculture and each is still surrounded by land under cultivation. One area, Letterkenny Ordnance Depot, Franklin County, affords an example of the changes that occur on good agricultural lands when removed from farming, while the other area, near Chaneysville, Bedford County, permitted comparison of two areas of poor soil, one abandoned, and the other farmed.

Approximately 3000 specimens, exclusive of parasites, were collected. The mammals were prepared as study skins using standard procedures and, together with field notes and photographs, are deposited in the Section of Mammals, Carnegie Museum, Pittsburgh, Pennsylvania.

In addition to our mammal specimens, digestive tracts of predators were obtained from trappers and preserved, and a large series of owl pellets was preserved. The analysis of this material was made available to PR-36R and was included in the final report of that project—*Food of Predaceous Animals in Northeastern United States* (Latham 1950).

LOCALITIES TRAPPED AND STUDIED

Trapline No.	*Location*	*Trapping Dates*
ADAMS COUNTY		
5.	4½ mi. W. East Berlin	March 24-27, 1949
7-8.	1 mi. S. East Berlin	March 29-April 5, 1949
122.	6 mi. W. N. W. Cashtown	May 6-17, 1950
123A-B.	6 mi. W. N. W. Cashtown	May 9-18, 1950
124.	3¼ mi. W. N. W. Cashtown ..	May 12-14, 1950
132.	4 mi. N. W. Cashtown	June 6-8, 1950
133.	2 mi. N. W. Arendtsville	June 6-8, 1950
BEDFORD COUNTY		
12-13.	6 mi. N. W. Imler	May 4-8, 1949
14.	7 mi. N. W. Imler	May 4-8, 1949
15-16.	1 mi. N. E. Osterburg	May 7-15, 1949
17.	1½ mi. W. Imler	May 9-13, 1949
18.	1 mi. N. E. Osterburg	May 11-16, 1949
19.	2¾ mi. S. Osterburg	May 11-15, 1949
20.	6 mi. N. N. W. Imler	May 16-19, 1949
21.	1 mi. N. E Osterburg	May 19-23, 1949
22.	2 mi. E. Osterburg	May 23-June 2, 1949
74.	4¾ mi. N. E. Chaneysville	November 22, 1949-March 1, 1950
75.	5 mi. E. S. E. Chaneysville ...	November 22, 1949-March 1, 1950
76-77-78-79-83-84.	1½ mi. S. Clearville	November 22, 1949-March 1, 1950
80-81-82.	5¼ mi. E. S. E. Chaneysville .	November 22, 1949-March 1, 1950
85-86.	4¾ mi. N. E. Chaneysville ...	November 22, 1949-March 1, 1950
87-88.	1¼ mi. S. Clearville	November 22, 1949-March 1, 1950
89-90.	1 mi. N. W. Clearville	November 22, 1949-March 1, 1950
91.	1½ mi. N. Clearville	November 22, 1949-March 1, 1950
92-93.	3 mi. S. Clearville	November 22, 1949-March 1, 1950
94-95-96.	3½ mi. S. E. Chaneysville	November 22, 1949-March 1, 1950
97-98-99.	4½ mi. S. E. Chaneysville	November 22, 1949-March 1, 1950
100.	1½ mi. S. E. Chaneysville	November 22, 1949-March 1, 1950
101-102.	3 mi. S. W. Everett	November 22, 1949-March 1, 1950
103-104-105.	6 mi. S. W. Everett	November 22, 1949-March 1, 1950
106.	1 mi. W. Everett	November 22, 1949-March 1, 1950
107.	½ m. S. W. Everett	November 22, 1949-March 1, 1950

Trapline No.	*Location*	*Trapping Dates*
108.	4 mi. W. Chaneysville	November 22, 1949-March 1, 1950
109.	4 mi. S. E. Chaneysville	November 22, 1949-March 1, 1950
110.	3¼ mi. N. Clearville	November 22, 1949-March 1, 1950
111.	1½ mi. N. E. New Paris	March 6-15, 1950

BLAIR COUNTY

23.	3½ mi. S. E. Tyrone	June 7-13, 1949
24.	4½ mi. S. E. Tyrone	June 7-13, 1949

CUMBERLAND COUNTY

126.	4½ mi. S. E. Cleversburg	May 22-24, 1950
144.	4 mi. N. McRea	July 14-18, 1950
145.	2½ mi. N. McRea	July 15-18, 1950
148.	1 mi. W. Plainfield	July 18-20, 1950

FRANKLIN COUNTY

Winter Study.	7 mi. N. W. Chambersburg ...	November 26-December 17, 1949
1.	6 mi. N. N. W. Chambersburg .	December 29, 1948-January 15, 1949
2.	5 mi. N. W. Chambersburg ...	December 30, 1948-January 15, 1949
3-4.	5 mi. N. W. Chambersburg ...	January 16-30, 1949
121.	3½ mi. E. N. E. Mont Alto ...	May 3-10, 1950
125A.	5¼ mi. E. S. E. Mont Alto	May 17-22, 1950
125B.	5 mi. E. S. E. Mont Alto	May 18-22, 1950
128.	2½ mi. E. Fayetteville	May 24-26, 1950
129.	2 mi. N. E. Mont Alto	May 31-June 5, 1950
130.	2½ mi.. N. E. Mont Alto	June 1-7, 1950
131.	1½ mi. S. E. Fayetteville	June 6-8, 1950

FULTON COUNTY

49.	3½ mi. S. E. Crystal Spring ..	September 26-29, 1949
52.	2½ mi. W. Sipes Mill	September 28-October 3, 1949
50.	2 mi. E. Warfordsburg	September 27-October 3, 1949
51.	1½ mi. N. E. Warfordsburg ..	September 27-October 3, 1949
53-54.	2½ mi. S. E. Amaranth	September 28-October 3, 1949
55.	2 mi. W. Sipes Mill	October 1-5, 1949
56.	3½ mi. S. S. E. Crystal Spring.	October 3-5, 1949
57.	5 mi. S. Crystal Spring	October 5-11, 1949
58.	5½ mi. S. Crystal Spring	October 6-11, 1949
59.	4½ mi. S. Crystal Spring	October 3-31, 1949
60.	5 mi. S. S. W. Crystal Spring ..	October 11-16, 1949
61.	5 mi. S. Crystal Spring	October 16-20, 1949
62.	5 mi. W. Needmore	October 18-21, 1949
63.	3 mi. W. McConnellsburg	October 19-29, 1949
64.	Crystal Spring	October 24-28, 1949
65.	3 mi. W. McConnellsburg	October 24-29, 1949
66.	Crystal Spring	October 27-31, 1949
67.	4½ mi. S. Crystal Spring	October 30-November 8, 1949

Trapline No.	*Location*	*Trapping Dates*
68.	4½ mi. N. W. Warfordsburg ..	October 31-November 3, 1949
69.	5 mi. W. Needmore	October 30-November 1, 1949
70.	2½ mi. S. E. Crystal Spring ..	November 1-10, 1949
71.	3 mi. S. S. E. Amaranth	November 6-9, 1949
72.	2½ mi. N. N. E. Amaranth ...	November 6-9, 1949
73.	2½ mi. S. E. Crystal Spring ..	November 7-8, 1949
150.	½ mi. S. Fort Littleton	August 8-14, 1950
156.	3½ mi. N. E. McConnellsburg.	August 22-25, 1950

HUNTINGDON COUNTY

25.	1 mi. N. E. Sprnce Creek	June 8-16, 1949
26-27.	2 mi. S. W. Pennsylvania Furnace	June 15-21, 1949
28.	2 mi. S. W. Pennsylvania Furnace	June 16-21, 1949
29.	1 mi. N. E. Spruce Creek	June 19-26, 1949
30.	1½ mi. S. S. W. Pennsylvania Furnace	June 27-July 4, 1949
31.	2 mi. N. E. Spruce Creek	July 5-8, 1949
32.	2 mi. N. E. Spruce Creek	July 19-23, 1949
34.	5½ mi. N. E. McAlevy's Fort .	August 1-5, 1949
34.	5½ mi. N. E. McAlevy's Fort .	August 12-15, 1949
149.	½ mi. N. W. Shade Gap	August 1-9, 1950
151.	5½ mi. S. Shade Gap	August 10-14, 1950
152.	1 mi. S. E. Orbisonia	Augnst 15-18, 1950
153-154.	1½ mi. N. Orbisonia	Augnst 16-19, 1950
155.	8 mi. S. Shade Gap	August 20-23, 1950
157.	6½ mi. S. Shade Gap	August 28-31, 1950

JUNIATA COUNTY

45.	3½ mi. N. W. Mifflintown ...	August 29-30, 1949
46.	4 mi. N. W. Mifflintown	August 30-September 5, 1949

MIFFLIN COUNTY

33A.	3 mi. W. S. W. Milroy	July 26-August 1, 1949
33B.	3 mi. W. S. W. Milroy	August 3-9, 1949
33C.	3 mi. W. S. W. Milroy	August 12-17, 1949
35.	3½ mi. W. Milroy	Augnst 5-10, 1949
36.	5½ mi. W. N. W. Reedsville ..	August 9-12, 1949
37.	5½ mi. W. N. W Reedsville ..	August 10-15, 1949
38.	3½ mi. W. S. W. Milroy	August 11-17, 1949
39.	3½ mi. W. S. W. Milroy	August 17-22, 1949
40.	5 mi. W. Milroy	August 19-23, 1949
41.	4½ mi. W. Milroy	August 19-23, 1949
42.	2 mi. N. W. Milroy	August 21-26, 1949
43.	4 mi. W. Milroy	August 23-26, 1949
44.	1 mi. S. W. Milroy	August 23-24, 1949
47.	1 mi. N. N. W. Reedsville	September 1-5, 1949
48.	Reedsville	September 5-8, 1949

Trapline No.	*Location*	*Trapping Dates*
PERRY COUNTY		
134.	5 mi. S. S. W. New Bloomfield.	June 14-18, 1950
135.	3¾ mi. S. New Bloomfield ...	June 14-21, 1950
136.	3½ mi. S. E. New Bloomfield..	June 16-22, 1950
137.	1 to 2 mi. S. E. New Bloomfield	June 20-26, 1950
138.	5 mi. S. S. W. New Bloomfield.	June 22-28, 1950
139.	4½ mi. S. New Bloomfield ...	June 28-30, 1950
140.	2 mi. S. New Bloomfield	July 6-8, 1950
141.	8 mi. S. W Landisburg	July 7-13, 1950
142.	8 mi. S. W. Landisburg	July 8-13, 1950
143.	5½ mi. S. W. Landisburg	July 9-13, 1950
146.	6 mi. S. Landisburg	July 15-18, 1950
147.	4 mi. S. E. New Bloomfield ...	July 17-20, 1950
YORK COUNTY		
6.	4¾ m. N. N. E. Hanover	March 26-29, 1949
9.	6 mi. S. W. Dover	April 5-9, 1949
10-11.	4¾ mi. N. N. E. Hanover	April 11-15, 1949
112.	4½ mi. N. E. Delta	March 28-31, 1950
113-114.	2½ mi. N. E. Delta	March 30-April 7, 1950
115.	4½ mi. N. E. Delta	March 30-April 30, 1950
116.	3 mi. N. N. E. Airville	April 10-15, 1950
117.	3½ mi. N. Delta	April 14-17, 1950
118.	3 mi. N. Delta	April 14-17, 1950
119.	1½ mi. E. N. E. Delta	April 18-24, 1950
120.	3 mi. N. Delta	April 19-26, 1950

CHECK LIST OF THE MAMMALS OF SOUTH CENTRAL PENNSYLVANIA

Order MARSUPIALIA (Marsupials)

Family DIDELPHIDAE (Opossums)

Didelphis virginiana virginiana Kerr-Virginia Opossum

Order INSECTIVORA (Moles and Shrews)

Family TALPIDAE (Moles)

Scalopus aquaticus aquaticus (Linnaeus)—Naked Tailed Mole
Parascalops breweri (Bachman)—Hairy Tailed Mole
Condylura cristata (Linnaeus)—Star Nosed Mole

Family SORICIDAE (Shrews)

Sorex cinereus cinereus Kerr—Masked Shrew
Sorex cinereus fontinalis Hollister—Maryland Shrew
Sorex dispar Batchelder—Big-tailed Shrew
Sorex fumeus fumeus Miller—Smoky Shrew
Sorex palustris albibarbis (Cope)—White Chinned Water Shrew
Cryptotis parva parva (Say)—Little Short Tailed Shrew
Blarina brevicauda brevicauda (Say)—Large Short Tailed Shrew

Order CHIROPTERA (Bats)

Family VESPERTILIONIDAE (Highly specialized bats)

Myotis lucifugus lucifugus (LeConte)—Little Brown Bat
Myotis keenii septentrionalis (Trouessart)—Trouessart Bat*
Myotis subulatus leibii (Audubon and Bachman)—Leib Bat*
Myotis sodalis Miller and Allen—Indiana Bat*
Lasionycteris noctivagans (LeConte)—Silver-haired Bat*
Pipistrellus subflavus subflavus (F. Cuvier)—Georgia Pigmy Bat*
Pipistrellus subflavus obscurus Miller—New York Pigmy Bat
Eptesicus fuscus fuscus (Beauvois)—Big Brown Bat
Lasiurus borealis borealis (Muller)—Northern Red Bat
Lasiurus cinereus (Beauvois)—Hoary Bat*
Nycticeius humeralis (Rafinesque)—Rafinesque's Bat*

Order CARNIVORA (Carnivorous Mammals)

Family URSIDAE (Bears)

Euarctos americanus americanus (Pallus)—Black Bear*

Family PROCYONIDAE (Raccoons)

Procyon lotor lotor (Linnaeus)—Eastern Raccoon

Family MUSTELIDAE (Weasels, martens, minks, otters, skunks)

Martes pennanti pennanti (Erxleben)—Fisher†
Mustela rixosa allegheniensis (Rhoads)—Allegheny Least Weasel
Mustela frenata noveboracensis (Emmons)—Long Tailed Weasel
Mustela vison mink (Peale and Beauvois)—South Eastern Mink
Lutra canadensis canadensis (Schreber)—North Eastern Otter†
Spilogale putorius (Linnaeus)—Allegheny Spotted Skunk
Mephitis mephitis nigra (Peale and Beauvois)—Eastern Skunk

Family CANIDAE (Wolves and Foxes)

Vulpes fulva fulva (Desmarest)—Eastern Red Fox
Urocyon cinereoargenteus cinereoargenteus (Schreber)—Eastern Gray Fox
Canis latrans Say—Coyote*
Canis lupus lycaon Schreber—Timber Wolf†

Family FELIDAE (Cats)

Lynx canadensis canadensis Kerr—Canada Lynx†
Lynx rufus rufus (Schreber)—Wild Cat*
Felis concolor cougar (Kerr)—Panther

Order RODENTIA (Rodents)

Family SCIURIDAE (Squirrels)

Marmota monax monax (Linnaeus)—South Eastern Woodchuck
Tamias striatus lysteri (Richardson)—North Eastern Chipmunk
Tamiasciurus hudsonicus loquax Bangs—Red Squirrel
Sciurus carolinensis leucotis (Gapper)—Northern Gray Squirrel
Sciurus niger vicinus (Gray)—Northern Fox Squirrel*
Sciurus niger rufiventer (Geoffrey)—Western Fox Squirrel*
Glaucomys volans volans (Linnaeus)—Eastern Flying Squirrel

Family CASTORIDAE (Beavers)

Castor canadensis canadensis Kuhl—Canadian Beaver*

Family CRICETIDAE (Native Rats and Mice)

Peromyscus maniculatus nubiterrae (Rhoads)—Cloudland Deer Mouse
Peromyscus maniculatus bairdii (Hoy and Kennicott)—Prairie White-footed Mouse
Peromyscus leucopus noveboracensis (Fischer)—Fischer's Deer Mouse

Neotoma magister Baird—Allegheny Wood Rat
Synaptomys cooperi stonei Rhoads—Stone Lemming Mouse
Clethrionomys gapperi gapperi (Vigors)—Gapper Red-backed Mouse
Microtus pennsylvanicus pennsylvanicus (Ord)—Pa. Meadow Mouse
Pitymys pinetorum scalopsoides (Audubon and Bachman)—Pine Woods Mouse
Ondatra zibethica zibethica (Linnaeus)—Common Muskrat

Family MURIDAE (Old World Rats and Mice)

Mus musculus musculus Linnaeus—House Mouse
Rattus norvegicus (Erxleben)—Norway Rat
Rattus rattus rattus (Linnaeus)—Black Rat†

Family ZAPODIDAE (Jumping Mice)

Zapus hudsonius hudsonius (Zimmerman)—Hudson Bay Jumping Mouse
Napaeozapus insignis insignis (Miller)—Woodland Jumping Mouse

Family ERETHIZONTIDAE (American Porcupines)

Erethizon dorsatum dorsatum (Linnaeus)—Canada Porcupine

Order LAGOMORPHA (Hares, Rabbits)

Lepus americanus virginianus (Harlan)—Virginia Varying Hare
Sylvilagus floridanus mearnsii (Allen)—Mearn's Cottontail
Sylvilagus transitionalis (Bangs)—New England Cottontail

Order ARTIODACTYLA (Even-toes Hoofed Mammals)

Family CERVIDAE (Deer)

Cervus canadensis canadensis (Erxleben)—Wapiti or Eastern Elk†
Odocoileus virginianus borealis (Miller)—Northern White-tailed Deer
* Known to occur in this section, not collected by this Project.
† Extinct in this section.

DISCUSSION BY SPECIES

GAME AND FURBEARERS

WHITE-TAILED DEER

Odocoileus virginianus borealis

DISTRIBUTION: Occurs in all counties, although local in the extensive unbroken regions of intensively farmed country in the southeastern counties. Common throughout the South Mountain and Ridge and Valley Sections.

HABITAT: Forested areas. Deer range through and feed in farmland, both fields and woodlots, but thrive only in areas which have enough forest to furnish them some retreat from disturbance.

NOTES: Deer of the subspecies *(borealis)* were stocked in Pennsylvania from the more northern states early in the century. The subspecies found in this sector originally may have been *virginianus*, which is slightly smaller and redder. Probably interbreeding has eliminated any distinctions by this time.

We saw deer sign in every area where we worked except in the Triassic Lowlands near the York-Adams County line, and we were told that deer were occasionally known to move through there. Deer, as residents,

are limited in the closely farmed regions in the southeastern counties to areas where some extensive woods exist, such as along the larger streams. Throughout the South Mountain and Ridge and Valley Sections, however, they are common and are often seen on the farmland between the ridges as well as on the mountains.

Nowhere in this sector have we seen the marked deer damage to forests such as there is in northern Pennsylvania. Most of the forests here still have a good amount of brushy undergrowth. The numerous deeply worn deer trails and the distinct browse line of the northern forests is not apparent here. We have heard no reports of deer dying from malnutrition. Locally, we did see some evidence of over-browsing by deer in the northern part of this sector. Winter starvation is not likely to occur as the winters are usually open, and good farmland lies close at hand in almost all parts of the Ridge and Valley Province. Probably the nearness of almost all points in the forests to a road of some sort, and the more evenly distributed human population, causes this section to me hunted more thoroughly than the Big Woods areas of the northern counties.

Between 1900 and 1915, when it appeared for a time that the deer might become extinct in Pennsylvania, there still were deer in the south-central counties. They were common in the South Mountains. In the Game Commission files is a blueprint of a starshaped pen trap dated 1915 that was used to trap deer for transfer out of Quincy Township, Franklin County. The success of this effort is not known; however, deer damage to the orchards continued there and resulted in Pennsylvania's first antlerless deer season in 1923. This was open only to holders of a special permit and was limited to two townships, Quincy and Washington, in southeast Franklin County. This early attempt to control the deer met with much opposition from the public and only eight deer were removed.

A comparison of the 1915 and 1949 deer seasons is given in the following table. The South Mountains are on the Adams-Franklin County line and account for the large number of deer taken in those counties.

Deer Kill in South Central Pennsylvania

County	*1915 Legal Antlered**	*1949 Legal Antlered***	*1949 Legal Antlerless*
Adams	100	122	23
Bedford	0	677	Closed
Blair	0	646	1,109
Cumberland	75	219	420
Franklin	108	349	349
Fulton	16	349	Closed
Huntingdon	107	1,119	1,742
Juniata	5	348	463
Mifflin	46	428	1,890
Perry	22	387	Closed
York	0	81	32
Area totals	479	4,725	6,239
State totals	1,287	46,602	84,121
% State kill	37%	10%	7.4 %

* Deer with spike over 2" long, legal.

** Deer with 2 points to one beam, "spikes" not legal.

BLACK BEAR

Euarctos americanus americanus

DISTRIBUTION: Occasionally reported from northern Blair, Huntingdon, Mifflin and Juniata Counties. Wandering individuals are reported to have appeared in most of the other mountainous counties during reeent years.

NOTES: Under present conditions, most of the forested ridges of the Ridge and Valley Section are probably not favorable for a resident bear population because, although they contain a large area in timber, it is in the form of long, narrow ribbons of forest in proximity to farmland at all points. The ridges are poorly watered, and extensive forested stream valleys are scarce. The Allegheny Front especially from Blue Knob north, the northern edge of this sector from the Front to Tuscarora Mountain, and a few smaller areas have extensive woods with forested streams. It is in these areas that bears are most often seen. Central Huntingdon County southwest Bedford County, and the South Mountain region superficially appear capable of supporting small resident bear populations.

During the last two seasons (1948 and 1949) only three bears were legally killed in our sector, two in Mifflin and one in Huntingdon County. It is possible that bears may den in part of the Seven Mountains region in Mifflin County since they are often seen there. On May 20, 1950, near this area, a bear killed two hogs each weighing about 300 pounds, according to Distriet Game Protector Sam Reed, of Pine Grove Mills. Most localities in the south and southeast of this sector have had no authenticated reports of bears for many years. During the four fiscal years 1946-50, only four bear damage complaints were paid in this area, two in Bedford, one in Blair, and one in Huntingdon County.

VARYING HARE or SNOWSHOE

Lepus americanus virginianus

DISTRIBUTION: Not definitely known in our sector at present.

HABITAT: Elsewhere in Pennsylvania it inhabits cold forests of the High Plateaus and Allegheny Mountains Sections. South and westward it beeomes localized and is apparently quite local in the southern Allegheny Mountain Section.

NOTES: We obtained no records of living hares in this section but we found one skull in the Seven Mountains region of Mifflin County. There along Tea Creek, the birch, hemlock, white pine forest is extensive. Chestnut oak is dominant back from the stream. Dense laurel and rhododendron is abundant.

Although the native varying hare was originally described from the Blue Mountain near Harrisburg, the eastern most ridge of the Ridge

and Valley Section, we have seen no evidence that the hare was ever common in this section. Rhoads reports (1903) that it was found west of Mount Union in Huntingdon County in 1896, but was not known in Juniata County at that time. A correspondent told him that there were no varying hares and never had been any in Franklin County (which includes some suitable appearing habitat in the South Mountains). The area from which they were reported in Somerset County by Grimm and Roberts (1950) lies within the Allegheny Mountain. It is possible that varying hares may occur along the Allegheny Front in Bedford and northern Blair Counties.

Between 1920 and 1926, varying hares, chiefly from Maine, were stocked in every county in our sector as follows: Adams 89, Blair 320, Bedford 163, Cumberland 232, Fulton 106, Franklin 148, Huntingdon 470, Juniata 201, Mifflin 169, Perry 148, York 113. They may still exist locally in a few places in this part of the Ridge and Valley Section, especially in the northern part.

SPECIMENS TAKEN. 1—Mifflin 1.

COTTONTAIL RABBIT

Sylvilagus floridanus mearnsii

DISTRIBUTION: Common in all counties.

HABITAT: The optimum habitat for rabbits supplies a mixture of herbaceous and woody plants. Briers and brushy places in agricultural areas are almost ideal, but the rabbit is not restricted to any particular habitat.

NOTES: According to Rhoads, the rabbit originally inhabiting Pennsylvania east of the Alleghenies was the subspecies *mallurus*. Dr. Doutt has referred our specimens to the subspecies *mearnsii*. Rabbits of this subspecies, as well as *alacer*, have been repeatedly released throughout this sector by the Pennsylvania Game Commission and by sportsmen's organizations. Thus the present taxonomic status of Pennsylvania cottontails is confusing.

In addition to our general observations on rabbits, we gave special attention to this species during our comparison of farmed and unfarmed areas at Letterkenny Ordnance Depot, Franklin County, and in a winter study of abandoned lands in southern Bedford County.

Richmond and Roslund (1949) mention the preference of rabbits for herbaceous plants of European origin associated with agriculture. Our observations seem to agree with theirs and seem to indicate the importance of these plants in influencing the density of rabbit populations.

In general, we encountered the best rabbit populations on farmed and recently abandoned lands of good fertility in the south-east counties of this section. On these lands, the availability of cover seemed to be the most important single factor influencing rabbit numbers. This was especially apparent in Franklin County where local agricultural prac-

tices involve intensive cropping or close pasturing of all available areas. Also in Franklin County is the Letterkenny Ordnance Depot where no farming has been permitted since April 1943, so it was possible to observe the changes that had taken place with land abandonment and to compare the two types of land-use. The principal changes that had taken place in the vegetation were in height and density rather than in species, except that the fields that had been under cultivation in 1942 were now in perennial weeds and grasses rather than the annuals associated with field crops. The dominant grasses present were the same that had been in the pastures, mostly blue grass *(Poa pratensis)* and timothy *(Phleum pratense)*. On the drier, less fertile soils, the dominant grass was Canada blue grass *(Poa compressa)*. In fact, throughout the Cumberland Valley there is little invasion of old fields with such common weed or poverty grasses as *Danthonia spicata* and *Andropogon virginicus*. Fields that had been in cultivation in 1942 now had a dense growth of asters and timothy with very little goldenrod. In the seven years since farming ceased on this area, the only important change was the gradual invasion of fields by woody plants, mostly briers. In marked contrast to abandoned farms on poor soils, the area was still producing an abundance of palatable forage—grasses and forbs. With the increase in cover and the absence of agricultural activity, the rabbit population expanded rapidly. Beginning in the winter of 1943-44, the Pennsylvania Game Commission was permitted to remove rabbits from the Depot for restocking areas open to public hunting. A record of the rabbits removed each year was made available to us. It is not possible to compute a per-acre yield of rabbits from these records as different areas of the Depot had been open to trapping in different years. However, the information did include the number of days trapped, and the maximum number of traps used, so it was possible to arrive at an approximate measure of abundance in terms of the amount of effort it took to obtain the rabbits. This is summarized below. Although the number of rabbits has varied from year to year, there is no apparent trend up or down in either the number taken or in the effort required to trap them. This would appear to agree with our observation that, after the first year, there has been no appreciable change in the vegetation. In other words, the amount of food and cover rapidly increased the first year and has remained almost constant since then. A comparison of trapping success on adjacent farmed and unfarmed areas is also given below.

Rabbits Live-Trapped and Transferred from Letterkenny Ordnance Depot

Season	*Catch*	*No. Traps*	*Trap-nights per rabbit**
1943-44	2,086	320	10
1944-45	1,581	320	13
1945-46	1,393	300	15
1946-47	1,948	300	10
1947-48	2,583	320 plus 20 for 1 week	8
1948-49	1,628	240 plus 50 for 3 weeks plus 40 for 2 weeks	12
Total	11,219		

* This is based on 20,300 trap nights annually and is the actual number of trap nights for the season 1948-49. In spite of annual variations in the number of traps, the length of time set, and the vagaries of weather, approximately the same effort is represented each year according to A. M. Crist, in charge of trapping and transfer.

Rabbits Live-Trapped in Parts of Franklin County in Winter of 1948-49*

Locality	*Catch*	*Trap-nights*	*Trap-nights per rabbit*
Ordnance Depot, unfarmed	1,328	13,500	10
Ordnance Depot, farmed	300	6,800	23
Ordnance Depot, combined areas	1,628	20,300	12
Study area, unfarmed	122	1,425	11
Study area, farmed	75	1,120	15
Borough of Chambersburg	142	3,000	21
Borough of Waynesboro	205	2,500	12

* From information supplied by A. M. Crist, Service Corps, George Bretz, Dave Franklin, and Edward Campbell, District Game Protectors.

It does not follow that abandonment of any agricultural land creates a high population of rabbits, or that rabbits continue to thrive there indefinitely. On numerous abandoned farms throughout the Ridge and Valley Section, dry and infertile lands appear to support a low rabbit population localized around areas of greater soil fertility or more moisture. The Federal Resettlement Project (now State Forest) in southern Bedford County demonstrates this tendency of rabbits to localize in favorable sites. Here we found that in winter rabbits tended to stay in the vicinity of old house sites, stream bottoms, small terraces, and other places where fertile soil tends to accumulate and suitable herbaceous vegetation thrives. All stages of successional development are present in this extensive area, and in some parts concealing cover is good, although over wide areas it is thin. Groundhog dens are scarce and localized in the more fertile spots where there is more food and cover. The area has never been closed to hunting and carries a heavy hunting pressure. A number of predators occur on the area, but less fox sign was seen there than at Letterkenny Ordnance Depot.

The two most obvious differences between the Franklin and Bedford County tracts studied are: the area of high rabbit population has been closed to hunting; the area with a low population has been heavily hunted. The area with a high rabbit population has fair to good moisture and good soil fertility as well as a variety of both woody and herbaceous plants; the area of low population has in general droughty, infertile soils and a stereotyped succession with little plant variety except locally. Whatever the controlling factors may be, they affect rabbits and groundhogs similarly.

Our observations on rabbit food habits, for the most part, duplicate those of other observers. Like Beule (1945), we found that barking of woody plants was heavy only when herbaceous plants were unavailable under snow. We found that use of woody plants was heavier in areas where green food was scarce, and that species that were ignored else-

where were used in such places. However, the presence of suitable green food of preferred species did not eliminate some cutting of wild rose, dewberry, blackberry, raspberry, and some tree seedlings in Bedford County during an extended winter period without snow. An ostensible preference of rabbits for transplanted tree and shrub seedlings has been noticed several times. In one case, a number of transplanted red oak seedlings had been cut, while natural seedlings of the same species nearby were undisturbed. In Franklin County, rabbits appeared to prefer the bark of small *Ailanthus* (Tree of Heaven), an exotic weed tree common in the southeastern counties. They appeared to be eating it more heavily than raspberry and blackberry growing nearby, although the briers are usually highly preferred foods.

SPECIMENS TAKEN. 14—Bedford 3, Cumberland 2, Fulton 6, Huntingdon 1, Mifflin 2.

NEW ENGLAND COTTONTAIL

Sylvilagus transitionalis

DISTRIBUTION. Not well known for our sector. Taken by us on Tea Creek in the Seven Mountains, Mifflin County, and near Caledonia State Park in the South Mountains, Adams County.

NOTES. The two we collected were in thick brush along forested streams well removed from farmland. They are known to occur in this habitat elsewhere in Pennsylvania and also in the relatively dry scrub-oak "barrens." This rabbit probably occurs all along the forested ridges and mountains of this section, although the common cottontail *(S. floridanus)* is the more abundant even in the same habitats.

SPECIMENS TAKEN. 2—Mifflin 1, Adams 1.

NORTHERN GRAY SQUIRREL

Sciurus carolinensis leucotis

DISTRIBUTION. Occurs in all counties.

HABITAT. Forests and farm woodlots, ranging out occasionally into rows of trees along fences, or small isolated groves, to feed and, less often, to nest or den. Gray squirrels also enter cornfields, near woods, to feed on corn.

NOTES. Grays squirrels are occasionally found in every forest type in this sector, but good populations usually occur in regions with plenty of mature, mast-bearing hardwoods. Probably the best squirrel population seen by us was in southern Fulton County during the fall of 1949. This area has an abundance of hickory, and hickory

nuts were common there that year and the year before. It also has plenty of wild grape, which gray squirrels use as nest material, travel highways, and cover. Squirrels were seen frequently on the mountain top in Fulton County, but during a long dry spell they appeared to be concentrated in the vicinity of surface water. During the hunting season in November, or shortly before, most of them appeared to have left the mountain top. However, thinning of the leaf cover there may have merely made them more wary and hard to see. Most of the shooting we heard that season was from the lower mountainside and hill land, and we believe that more squirrels were killed there.

We also saw good squirrel populations in 1950 in Perry County, especially in a forest of mixed conifers and nut trees, and in York County in mature timber along the Susquehanna River. We did not see many gray squirrels, or much sign, in the South Mountain region in the spring of 1950, although much suitable forest land was examined. The Pigeon Hills and farm woodlots in Adams County in 1949 showed signs of a better population. Hunters told us, and limited observation supports the information, that the river hillside forests along the Juniata River and the Raystown Branch are among the best squirrel woods in this sector.

We have noticed that gray squirrels have a liking for close cropped pastures as a place to bury nuts when they adjoin woods. Perhaps this is one reason why abandoned upland pasture in Pennsylvania often comes up in stands of trees with hickory predominating, and sometimes with walnuts common if the pasture is fertile and moist.

A gray squirrel collected February 14, 1949, in Franklin County had four embryos 18 millimeters long. A lactating female was taken in Fulton County early in August.

SPECIMENS TAKEN. 18—Adams 1, Franklin 1, Fulton 11, Huntingdon 1, Perry 1, York 3.

FOX SQUIRREL

Sciurus niger rufiventer

Sciurus niger vicinus

DISTRIBUTION. Probably in all counties, but scarce and local.

HABITAT. Wooded areas, either extensive or in small stands.

NOTES. Rhoads applied the name *neglectus* to the fox squirrel native to south central Pennsylvania, and quoted reports of it from every county in this sector except Blair. At the turn of the century, this native fox squirrel appears to have been scare, to almost extinct, in this area. Poole (1944) examined numerous old specimens of northeastern fox squirrels taken before stocking was initiated. He has shown

that the name *vicinus* should properly be applied to the pale fox squirrel native to south central Pennsylvania, and has referred two Franklin County specimens to this subspecies. He applies the name *neglectus* to the very gray fox squirrel occurring east of the Susquehanna River.

Between 1923 and 1936, the Pennsylvania Game Commission released fox squirrels *(rufiventer)* in every county in this sector in the following numbers: Adams 92, Blair 146, Bedford 130, Cumberland 197, Fulton 36, Franklin 41, Huntingdon 105, Juniata 100, Mifflin 111, Perry 41, York 213. Sportsmen's organizations are also known to have released a number. Although fox squirrels are successful at a number of other places in the state where stocking has been practiced, they appear to have made little or no progress in this sector. We had reports from local hunters of fox squirrels in Bedford, Cumberland, Franklin, Fulton, Perry, and York counties but they were reported as being scare and local.

We could find nothing in the nature of this section to explain the failure of fox squirrels to thrive there, and local hunters were equally at a loss to explain it. Elsewhere fox squirrels thrive in company with gray squirrels and show some preference for open stands of mature timber with hickory and walnuts. Such habitats are common in many places in this region.

Although we were unable to obtain any specimens of fox squirrels, a number of them were examined in local taxidermy shops. All of those seen which came from the Cumberland Valley were distinctive in appearance and fitted Poole's description of *vicinus*. Those examined were pale, sandy gray above, and the fur of the belly was dull or dirty-white, rather than rusty. There was little or no rusty red color in the tail. According to hunters, these large light-colored fox squirrels occur locally all along Conodoguinet Creek and Yellow Breeches Creek in Cumberland and Franklin Counties.

RED SQUIRREL

Tamiasciurus hudsonicus loquax

DISTRIBUTION. Occurs in all counties. Much more common and well-distributed in the mountains, especially in the northern parts of this region.

HABITAT. Most common in this sector in forests or woodlots of white pine and hemlock; occasionally found in forests of pitch or scrub pine, or in hardwoods.

NOTES. We found red squirrels common along Tea Creek in Mifflin County, in the vicinity of Blue Knob in Bedford County, in the vicinity of Spruce Creek in Huntingdon County, and in the South Mountain region. Elsewhere in the monntains we saw occasional sign, usually in pitch pine and hemlock areas, and a few squirrels. Residents in the mountainous areas are well acquainted with the animal. In the southern and more lowland parts, red squirrels are quite local in

distribution. We were told that in southern Bedford and Fulton Counties they are scarce in scrub pine and pitch pine areas and in hardwoods, usually being found in hemlock areas near streams. In the Cumberland Valley and the Triassic Lowlands of Adams County, several residents did not know the red squirrel, but some local people assured us that they sometimes occur there. Rocky wooded areas of pines and hardwoods along some streams there appear suitable. In southern York County we saw a red squirrel food midden in a black birch-hemlock ravine near the river. We were told by a local hunter that they were common in thick bushy hardwoods near the slate dumps at Delta. Although woods where we have found this squirrel were usually dense with much top cover, we have occasionally seen or taken it in open stands of oak and pitch pine.

In this sector, red squirrels share the same localities, and even the same woods, with gray squirrels. Where white pines and hemlocks are mingled with oaks, hickories, or walnuts, or are adjacent to such forest, both red and gray squirrels are often present. We have not seen them living or feeding in close proximity in such places, and we got the impression that they did not mix freely. The general distribution of red and gray squirrels, both geographic and local, suggests that gray squirrels occupy the best territory and that red squirrels take what is left. Gray squirrels in good numbers occupy mature stands of hardwoods with abundant mast, and mixed hardwoods and conifers, whether red squirrels are present or not. The grays sometimes also occupy areas with little mast except conifer seeds, but we believe in much smaller numbers and with less success. Red squirrels appear to occupy nearly any sort of wooded cover, but they are most likely to be found in woods which produce little food except conifer mast or other seeds used, but not preferred, by gray squirrels. In the regions where hardwood forests predominate and gray squirrels are abundant, red squirrels are often restricted to areas of conifers, sub-mature hardwoods that produce little mast, or small isolated groves of trees. In brief, it is the red squirrel which occupies the submarginal habitats.

Accounts have often been written describing the red squirrel as a bold, tame, saucy animal which likes to investigate and scold man. However, most Pennsylvania red squirrels we have seen knew how to take care of themselves. The few scoldings we received were from concealed animals well out of shotgun range. On two occasions, we have seen red squirrels take refuge in holes among rock piles even though plenty of trees were near.

Food observations by us include heavy use of cones of the white pine, hemlock, and pitch pine beginning in July. We have observed some use of walnuts and acorns, and tiny green hickory nuts have been found which we believe were cut by red squirrels.

We have taken young red squirrels, just out of the nest, in early June, and from a pregnant female late in August. This would suggest more than one litter a year here.

SPECIMENS TAKEN. 11—Adams 5, Blair 1, Huntingdon 1, Mifflin 4.

GROUNDHOG or WOODCHUCK

Marmota monax monax

DISTRIBUTION. Occurs in all counties.

HABITAT. Occupies all habitat types in this sector. They occur in greatest numbers in and around fields and other grassy and weedy areas, especially where some brushy cover is near.

NOTES. Wherever sufficient herbaceous food is present, the habitat will support groundhogs, and usually does. Wood edges, stone piles, brushy fencerows, and other spots of cover are favored localities for dens, especially on the edges of fields of clover and alfalfa. Steep sides of small wooded ravines in farmland, and rocky hillsides along the larger streams, are usually well populated. Woods, in general, support a thinner population. We have also found them living on the edges of talus slopes, but not well out in the talus.

Dens are often dug well out in fields having only herbaceous cover, but, where more cover is present, dens are usually more numerous. This may not always be a case of preference for cover, but may sometimes be a result of the activities of the groundhog. We have noticed that in abandoned grassy fields, groundhog dens were often surrounded by small colonies of blackberry or dewberry briars, or sometimes shrubs and small trees. The idea that the groundhogs chose these spots of pre-existing cover for their dens passed without thought until it was noticed that sometimes old dens had a beginning colony of briars or seedlings too short for cover. Apparently in grassy areas the invasion of woody plants in facilitated by the spots of loose bare soil created by the groundhogs in their denning activities.

Groundhogs, like rabbits, usually are more abundant in areas of more fertile soil, probably because of the more abundant and more nutritious, herbaceous vegetation. The best general population seen by us was in southern York County, where dens were abundant in all neglected areas and in fencerows through the farmlands. On Letterkenny Ordnance Depot we found a high groundhog population on the unfarmed portion. There were twice as many den systems, and five times as many systems in use, as there were on an equal area of farmed land nearby. This confirmed the general observation that groundhogs had increased considerably on the Depot since farming was stopped and hunting ceased. Also, food and cover of the type preferred had increased considerably.

In a few places on the drier and less fertile shale lands of the Ridge and Valley Section, we found groundhogs scare on long-abandoned lands. They were concentrated around the moister and more fertile sites where there was good herbaceous growth. This was particularly noticeable in the Resettlement Project Area in southern Bedford County. In some of the more barren mountain forests in this section, groundhogs appeared almost confined to the vicinity of roads where they fed on herbaceous plants along the roadside.

Groundhogs were often seen to climb at least three feet up in small trees. One individual made the crotch of a small tree his habitual

sunning plaee. We often saw mud marks in small trees, on logs, and on leaning fence posts, near dens that eonvineed us that this habit is common. Another habit often observed was the searring of trees by groundhogs, espeeially in spring and early summer. The surfaces of young trees, usually from two to six inches in diameter, either living or dead, were scatehed and searred about a foot to two feet above ground. To judge by the marks, both teeth and elaws were used. Dead and barkless trees, fenee posts, and young live trees were often used, but larger trees less often. Bark, when present, appeared not to be eaten but left in shreds. Sueh marked trees were usually within a few feet of dens, but sometimes were several yards away along well beaten paths between dens. The signifieanee of this habit was not determined.

During the extremely mild winter of 1949-50, we saw evidenee of oecasional aetivity at groundhog dens after warm periods throughout the winter, both in Franklin and southern Bedford Counties.

Groundhogs from this sector show eonsiderable variation in color, the dominant grayish buff eolor varying toward blaek, brown, red and yellow, in different individuals.

Groundhog Dens Found on Study Area, Letterkenny Ordnance Depot

Type Area	*Acres Checked*	*Openings Found*	*Systems Found*	*In Use*	*Abandoned*
Unfarmed	75	87	33	20	13
Farmed	75	35	16	4	12

	Unfarmed	*Farmed*
Ratio of systems found	2	to 1
Ratio of openings found	2½	to 1
Ratio of abandoned systems found	1	to 1
Ratio of used systems found	5	to 1
Fraction of systems found in use	⅔	to ¼

SPECIMENS TAKEN. 18—Bedford 1, Cumberland 1, Franklin 3, Fulton 4, Huntingdon 5, Mifflin 1, Perry 3.

RACCOON

Procyon lotor lotor

DISTRIBUTION. Common in all counties.

HABITAT. Frequents almost all habitat types in this seetor.

NOTES. On almost every stream, large or small, in this seetor, "eoon" traeks can be found. They are less often seen on the sandy, rocky mountain streams, but probably this is only because such places do not reeord tracks so well. 'Coons often follow small streams and drains, hunting erayfish and other aquatic animals, but they do not confine their travels to the vicinity of water. Old logging roads and forest trails are also favored runways. We have even taken them on the edges

of a bare talus slope on a mountain crest about a mile from the nearest stream. They are little afraid of man. They enter cornfields to eat green or shocked corn. They often follow streams into the back yards of farm houses, and even go into small towns. A Fulton County farmer showed us where they had destroyed many chickens roosting in trees within a short distance of his house.

Wild cherries appear to be an important food in season.

From all reports, the number of raccoons has been increasing for the last several years. Certainly it is now one of the more common large animals in this section, although in the thirties it was considered to be in need of protection, and numbers of them were purchased by the Pennsylvania Game Commission and released in this area.

SPECIMENS TAKEN. 9—Bedford 2, Fulton 5, Mifflin 2.

OPOSSUM

Didelphis virginiana virginiana

DISTRIBUTION: Common in all counties.

HABITAT: Inhabits or frequents almost every habitat type in this sector.

NOTES. Like the raccoon, the opossum travels small muddy stream beds, creek banks, and ditches. His tracks are easily found in most localities, but the best way to learn how many opossums there are in an area is to set a line of fox traps. Even as Job had his boils, so the fox trapper has the 'possum as his own private affliction. Scarcely worth skinning, the opossum blunders into a set, thoughtfully chosen and made with care to catch a craftier animal, and often tears up the site so much that the trap must be moved.

It has long been known that the opossum will eat almost anything. Since almost all kinds of carrion, garbage, wild fruits, seeds, corn, small vertebrates, and, at least occasionally, game mammals and birds are eaten, the habitats created by man will support a large number of opossums. Four stomachs, collected in our area and analyzed, contained insects, earthworms, mice, a frog or toad, rabbit hair, snake scales, feathers, and pokeweed seeds.

By creating successional stages that bear abundant fruits and berries, by increasing the volume and variety of invertebrate and small vertebrate life, and by littering the highways with carrion of road-killed animals and our streams and roadsides with garbage dumps, we have invited the opossum to become abundant. The low price on his hide would seem to complete the invitation.

Opossums are little afraid of the works of man and wander boldly through the fields, into the farmyard, and even about towns at night. They occur from river bottoms to the tops of forested mountains in this sector. They appear to range all over the dry mountain top, but show some tendency to concentrate near water there. Like the skunk and raccoon, wet nights appear to increase their activity.

SPECIMENS TAKEN. 24—Bedford 1, Franklin 2, Fulton 11, Huntingdon 5, Mifflin 5.

BEAVER

Castor canadensis canadensis

DISTRIBUTION. Occurs in Blair, Bedford, Cumberland, Franklin, Fulton and Perry Counties. Colonies may exist in other counties.

HABITAT. Streams, usually small creeks in this section.

NOTES. According to Rhoads (1903) the beaver was extinct or nearly so in this sector by 1900. The present colonies are descended from stock imported and released by the Pennsylvania Game Commission beginning in 1917. During the two-week trapping season of February, 1950, eight beavers were caught in this section in the following counties: Blair 1, Bedford 1, Cumberland 1, Fulton 4, Perry 1.

District Game Protector Orrie Smith informed us that a beaver caught in Sideling Hill Creek, Bedford County, on February 12, 1950, contained three embryos. He also told us of two beaver colonies on Tonoloway Creek in southern Fulton County. We heard from other sources of a colony on Roaring Run, near McConnellsburg, and one in Horse Valley, Franklin County.

MUSKRAT

Ondatra zibethica zibethica

DISTRIBUTION. Occurs in all counties.

HABITAT. Marshy areas and slow-moving muddy creeks and runs; scarce to absent in swift rocky streams.

NOTES. Occasional sign was seen in all areas worked. We got the impression, from sign observed and from talks with trappers, that muskrats were not abundant, except locally, in the Ridge and Valley Section. Trappers reported that trapping pressure was heavy on many streams. The ease of trapping stream-dwelling muskrats and the consistently good price for their fur in recent years have probably encouraged this heavy trapping. In the southeastern counties we were also told that the muskrat take was high, but we saw signs of good populations in the Cumberland Valley and in Adams and in York counties. In these areas they seemed to thrive, even in some very small streams, wet ditches, and marshy swales without real "swimming water." Even streams with banks closely pastured had some muskrats.

Everywhere that we observed muskrats in this sector they were living in bank dens, except at Letterkenny Ordnance Depot where they had built several small houses in one small marshy pond. A trapper here informed us that he took many kits during the season of 1948-49, indicating a late breeding season in 1948.

In Bedford County, April 11, 1950, high on the mountain between two valley heads, a large male muskrat in breeding condition was found run over on the highway. It appeared to have been crossing the ridge from one small stream to the head of another.

SPECIMENS TAKEN. 2—Bedford 1, Franklin 1.

STRIPED SKUNK

Mephitis mephitis nigra

DISTRIBUTION. Common in all counties.

HABITAT. Inhabits or frequents almost every habitat in this sector.

NOTES. Striped skunks appear to thrive best in the farmlands of this sector, often denning in woodlots and neglected brushy areas, but frequenting even the closely-cropped pastures and cornfields, far from cover, in their search for insects. They are a frequent highway casualty in even the most closely farmed valley lands, especially in late summer and early fall. They also den in the mountain forests. We found skunks and their sign on forested mountain tops as high as three thousand feet. Like several other furbearers, they show a tendency to concentrate near surface water in such situations.

SPECIMENS TAKEN. 12—Adams 2, Bedford 3, Franklin 1, Fulton 4, Mifflin 1, York 1.

SPOTTED SKUNK

Spilogale putorius

DISTRIBUTION. Known in Pennsylvania only from southern Fulton and Bedford Counties on the Potomac drainage.

HABITAT. Known only from rocky forests on or near the crests of mountains in this state.

NOTES. The spotted skunk was first reported from Pennsylvania by Latham and Studholme (1947). Two individuals were caught by Mr. William Ritz on top of Sideling Hill Mountain, Union Township, Fulton County, Pennsylvania, about four miles south of Amaranth. These were taken at about 1500 feet elevation in a sandstone block area with a sub-mature forest of oaks, pitch pine, and scrub pine. This same local trapper caught two more specimens in the same place during the winter of 1949-50.

Mr. Crawford and his father have bought fur in Everett, Bedford County, for many years. For a number of years past they have been buying about one spotted skunk pelt a year. As near as he could remember, they all came from a local buyer near McConnellsburg, Fulton County. He offered to save the next skin bought, and during the season of 1949-50, saved two skins from Bedford County. These were the only pelts he bought that season, and were the first specimens he remembered from Bedford County. Mr. Crawford directed us to the trapper, a Mr. Robert Riggleman who told us that one skunk was a male and the other was a female. He trapped them in a dry, rocky, forested area on top of

Tussey Mountain, about six miles southwest of Chaneysville, Bedford County, at about 2000 feet elevation.

Mr. Riggleman remembered catching another specimen a few years before on top of Martin Mountain directly across Flintstone Creek from his Tussey Mountain locality. He believed that many old people in the vicinity had never seen one. His neighbor, Mr. Charles Schroyer, had taken several that year, and others in previous years, in a ravine with sandstone blocks on the side of Tussey Mountain a mile or two north of Riggleman's locality and near the junction of Tussey Mountain and Martin Hill. This ravine had large black birch trees, oaks, white pines, and tulip trees. Mr. Schroyer believed that most of his neighbors were unfamiliar with the animal.

Mr. Stanley Hawbaker, of Fort Loudon, Franklin County, buys much of the fur from the region east of Mr. Crawford's buying range. He has never bought a spotted skunk hide from Pennsylvania.

All localities mentioned where spotted skunks were taken are on the Potomac drainage within two to six miles of the Maryland line, and within nine to twenty miles of the Potomac River. Sideling Hill and Martin Mountain localities are about seventeen miles apart, with Gabriel Knob midway between.

A steel trap line about five miles long on the crest of Sideling Hill, fifteen miles northeast of Ritz' locality, passed through rocky wooded areas and yielded us twenty-five furbearers, including four striped skunks, but no spotted skunks. Therefore, we can scarcely believe that it is common in the area. All evidence indicates that the little spotted skunk is rare and local in this sector and unknown to many people in the area where it is found; that it is limited here to rocky, forested mountain areas; and that it has been present in this same status for about forty years at least.

Known Localities for the Spotted Skunk in Pennsylvania:

1. Sideling Hill Mountain, 4 miles S. of Amaranth, Fulton County, Pa.
   4 specimens to date—Mr. William Ritz.
2. Gabriel Knob, 1 mile E. of Artemas, Bedford County, Pa.
   1 specimen—Mr. Orrie Smith.
3. Tussey Mountain, 6½ miles SW. of Chaneysville, Bedford County, Pa.
   2 specimens—Mr. Robert Riggleman.
4. Martin Mountain, 6 miles SW. of Chaneysville, Bedford County, Pa.
   1 specimen—Mr. Robert Riggleman.
5. Tussey Mountain, about 5 miles SW. Chaneysville, Bedford County, Pa.
   Several specimens, exact number unknown—Mr. Charles Schroyer.

SPECIMENS TAKEN. 2—Bedford 2.

SOUTHEASTERN MINK

Mustela vison mink

DISTRIBUTION. Occurs in all counties.

HABITAT. Vicinity of streams, large and small. They may range well away from streams in hunting.

NOTES. Mink tracks were occasionally seen along streams in most parts of this sector, but we saw no great abundance of sign. Talks with trappers convince us that they are not as abundant here as they have been in western Pennsylvania during recent years. It is probable that they are more common along many small mountain streams than tracks would indicate, because the rocky margins of many such small streams here are poor for tracking. On the Juniata, and some of its larger tributaries, we found the most favorable appearing conditions and a fair number of tracks.

SPECIMENS TAKEN. 1—Franklin County 1.

NEW YORK WEASEL

Mustela frenata noveboracensis

DISTRIBUTION. Common in all counties.

HABITAT. Inhabits or frequents almost every habitat type in this sector.

NOTES. Talks with trappers convince us that, over much of our area, weasels are only locally common. In some counties, they are scarce as compared with most other furbearers. Although the counties included constitute 15% of the total area of Pennsylvania, they produced only 10% of the weasels offered for bounty in the two year period June 1, 1948 to May 31, 1950.

Weasels inhabit fields and fence rows in the farmlands, often near farm buildings. They also inhabit brushy areas and forests in the mountains well removed from farm land. In the winter, weasel tracks are most easily found near streams and along ditches. Brush piles, stone piles, stone fences and thick cover, such as briars or thickets, are preferred habitat features. Whether they commonly inhabit or range through the dry forested areas and the talus slopes on the mountains far from surface water was not learned.

District Game Protector A. M. Crist, in charge of rabbit trapping and transfer on Letterkenny Ordnance Depot, Franklin County, caught forty weasels there during the winter of 1947-48, but only about a dozen the next winter in spite of much warm, wet weather which he assures us is best for weasel trapping. Whether his trapping was the cause of the ostensible decline, or merely reveals a decline from other causes, is not known.

Mr. William Ritz, an experienced trapper of Fulton County, told us that in the past he had taken a number of white weasels there but had not taken one for about fifteen years.

The weasel is an occasional highway casualty in this sector. We found one skull in a pellet from a barred owl in Bedford County. A fragment of a weasel skull in a barn owl pellet from Franklin County is probably this species.

During the fiscal year June 1, 1949 to May 31, 1950, bounties were paid on weasels from this sector as follows: Adams 158, Bedford 299, Blair 189, Cumberland 145, Franklin 119, Fulton 84, Huntingdon 173, Juniata 92, Mifflin 112, Perry 152, York 450.

SPECIMENS TAKEN. 5—Bedford 1, Franklin 1, Huntingdon 1, Mifflin 1, Perry 1.

LEAST WEASEL

Mustela rixosa allegheniensis

DISTRIBUTION. Probably occurs only in the Ridge and Valley Section and possibly in the nearby Cumberland Valley. In our sector it is known from Bedford, Blair, Franklin, Fulton, Huntingdon, and Mifflin Counties.

HABITAT. The least weasel is known from both wooded and grassy habitats in Pennsylvania, but is probably more often found in the latter.

NOTES. We never saw a least weasel, nor any certain sign of one, during our work in this sector. We talked to few people who had seen them. Except for the very short tail, this tiny weasel is somewhat a miniature of the common New York weasel. This may sometimes lead farmers and trappers, who have seen it, to mistake it for a young New York weasel. In any event, it is probable that the southeastern limit of its range in Pennsylvania lies in this sector, and that through most of this area it is scarce and local when present. In some parts, however, it may be more common than bounty figures would indicate. Because of its small size, it probably often escapes the trappers' notice, and might even cross traps without springing them.

District Game Protector Orrie Smith, of Amaranth, caught a least weasel in Pigeon Roost Gap on Martin Hill, Bedford County in 1927. He had tracked it in the snow into a hole in a stump and found it had killed a deer mouse by biting it through the head.

Mr. William Ritz, near Amaranth, has caught only two least weasels in many years of trapping. He caught one during the winter of 1949-50, and one in the same place several years before—Sideling Hill Mountain near the Maryland line.

Between February, 1948 and October, 1950, least weasels were probated for bounty in the following numbers from this sector: Bedford 25,

Blair 1, Franklin 2, Fulton 4, Huntingdon 2. These distribution records were supplied by Mr. Harold L. Plasterer, Supervisor, Bounty Claims Section, Pennsylvania Game Commission.

RED FOX

Vulpes fulva

DISTRIBUTION. Common in all counties.

HABITAT. Frequents almost every habitat type in this sector.

NOTES. Red foxes were reported to be fairly common in all parts of this sector. We have no reason to believe them abundant except locally in a few places. Some observers believe they were more abundant a few years ago, especially in the South Mountain region. On Letterkenny Ordnance Depot we found a fair amount of fresh sign, but much more sign from a year or so preceding. Observers there agree that they have declined in numbers. In Fulton County, we saw a fair amount of fresh sign of foxes. We trapped two male red foxes along the crest of Sideling Hill Mountain.

In Bedford County, we clocked a red fox running along the highway in front of our car between roadside fill and rock cliffs. It ran about 30 miles an hour for a short distance, probably not over fifty yards. Foxes are not often highway casualties, but we have heard three accounts of red foxes being killed on the Pennsylvania Turnpike.

On January 3, 1949, Mr. Harold Plasterer, Supervisor, Bounty Claims Section, Pennsylvania Game Commission, received the skins of two completely white foxes. He learned that these animals were killed to protect domestic ducks by Mr. Harold Ramsey, R. D. 1, Hopewell, Bedford County, during early September 1948. The second of these white foxes was shot in the same place two or three days after the first. In each case the white fox was in company with a red fox. Mr. Plasterer, after careful examination of the skins, was certain that they were white color phases of the red fox, similar in fur color to true albinos. Since 1923, Mr. Plasterer has seen more than 128,000 red fox pelts through the bounty claims section, but only these two skins were completely white.

It was also learned that Mr. Fred Crawford, well known sportsman of Everett, Pennsylvania, killed another white fox in the same vicinity about two weeks after these were taken by Mr. Ramsey. We examined this specimen which is mounted in Mr. Crawford's store in Everett. It is an adult red fox, pure white, except for the faintest tinge of rusty yellow on the fur of the legs, ears, and base of the tail—the places where a red fox is normally black. Mr. Crawford said that the eyes were not pink, but a normal color, so the specimen probably should not be termed an albino but rather a white color phase.

On March 1, 1950, District Game Protector Owen Seelye, of Port Royal, obtained for us a silver fox killed in his district a few days before. This was an adult male similar in appearance to commercially raised

silver foxes. It was killed about one mile south of McAllisterville, Juniata County, by Mr. Ralph Bashore in a field on his farm. There is no silver fox farm in the near vicinity, but the animal may have travelled there from some distant farm.

During the fiscal year June, 1948 to May, 1949, 2,454 red foxes were offered for bounty from our eleven-county area. A comparison of the bounty figures by counties is included in the discussion of the gray fox.

SPECIMENS TAKEN. 7—Bedford 2, Franklin 2, Fulton 2, Juniata 1.

GRAY FOX

Urocyon cinereoargenteus cinereoargenteus

DISTRIBUTION. Common in all counties.

HABITAT. Frequents almost every habitat type in this sector.

NOTES. Gray foxes were reported to be common in all parts of this sector. Their tracks were often found in the dust, or mud, of old lumber roads and trails through the mountain forests. They hunt even through the thick, barren, scrub oak areas and dense, briar thickets, but they seem to prefer to follow trails through them when possible. Gray foxes seemed particularly common in southern Fulton County. During our work there, we saw gray foxes during daylight hours several times.

During the fiscal year June 1, 1948 to May 31, 1949, there were 4,422 foxes (reds and grays) offered for bounty from this 6,946 square miles area, or approximately six foxes from each ten square miles. There is no apparent correlation between the ratio of red to grays and the per cent of land in farms. The following table shows the number of foxes of each species that was presented for bounty from each of the counties covered by this report in the year June, 1948 to May, 1949:

County	*Red Fox*	*Gray Fox*	*% land in farms*
Adams	108	116	78.7
Bedford	318	179	64.2
Blair	157	155	45.0
Cumberland	258	97	65.0
Franklin	257	184	69.7
Fulton	124	156	62.1
Huntingdon	347	331	44.5
Juniata	143	116	55.4
Mifflin	172	127	45.0
Perry	251	136	53.7
York	319	371	81.4
Total for area	2,454	1,968	
Total for state	17,561	17,770	

BOBCAT

Lynx rufus rufus

DISTRIBUTION. Probably occurs in all counties, except York, at least as an occasional wandering individual. We have seen specimens, or heard reports, from Bedford, Fulton, Franklin, Huntingdon, Mifflin and Perry Counties.

HABITAT. In our sector, the bobcat is apparently most successful in the mountains which supply rocky areas suitable for denning and refuge from hunters with dogs.

NOTES. During our work, we saw only one live bobcat, a rather small specimen which ran in front of our car headlights in the State Forest along Tea Creek, Mifflin County, in the south edge of the Seven Mountains region. Populations of bobcats exist in the Martin Hill region of Bedford County, in southern Fulton County, in the region about Shade Gap and Orbisonia in Huntingdon County, and probably in the South Mountain region of Adams, Franklin and Cumberland Counties. In most other parts of the mountains, they are regarded by local people as having been exterminated, or rare, although an occasional story is heard of a specimen being killed or seen.

District Game Protector Orrie Smith, of Amaranth, Fulton County, has trapped many bobcats in Fulton and Bedford Counties. About 1927, in the vicinity of Martin Hill, Bedford County, he trapped fifteen bobcats in one season. His largest cat, a forty-four pound, fifty-six inch male, was caught in Fulton County on Town Hill Mountain, about nine miles north of the Maryland line in 1937. This is believed to be the record weight for a bobcat from Pennsylvania. He has taken three cats from Town Hill Mountain and vicinity since that time. His last Fulton County bobcat was taken on State Game Lands No. 65 about 1943. He told us that there are still bobcats on Sideling Hill Mountain, just south of U. S. Route 30. Another local man said he had seen one in that vicinity as recently as January, 1950.

A bounty of fifteen dollars was removed from the bobcat in 1937. During the eight years previous to this, a bounty was paid on from 97 to 211 bobcats per year. The highest number of bobcat bounties paid in Pennsylvania since 1915 was 792 claims paid in thirteen and one-half months during 1915-1916.

FERAL DOGS, CATS AND COYOTES

NOTES. We heard few reports of feral dogs in this sector and doubt if truly feral dogs are common here. In a few areas, however, we saw much evidence of farm dogs roaming the woods and fields, some during the season when rabbits are breeding most heavily. Cats were often seen along forested roads, well away from human habitation. Most of these were probably not feral, however, judging by their actions. On Letterkenny Ordnance Depot a considerable feral cat population exists.

These, District Game Protector A. M. Crist tells us, are descended from cats left by farmers when they moved off the area. The project leader has seen a cat chasing an adult rabbit so closely that both were almost run over by his car. In York and Adams counties, we found a high population of farm cats. Large numbers were seen hunting through the fields almost every day.

The status of the coyote is always interesting as it is not native to this region. The only record we could find of it here is a specimen in the Carnegie Museum that was taken near Flowing Spring, Blair County, in 1907.

OTTER

Lutra canadensis canadensis

DISTRIBUTION. Probably extinct in south central Pennsylvania.

HABITAT. Streams, lakes, wooded swamps.

NOTES. We heard no reports of otters anywhere in this section. However, there are resident populations of this species elsewhere in the state. There is a possibility that an occasional individual may exist here. The lower Susquehanna and parts of the Juniata rivers offer what appears to be suitable habitat.

INSECTIVORE

EASTERN MOLE

Scalopus aquaticus aquaticus

DISTRIBUTION. Occurs throughout the southeastern counties. Probably penetrates the Ridge and Valley Section, along the Juniata River, as far as Lewistown. May possibly occur elsewhere in valley lands of the Ridge and Valley Section but, if so, it cannot be common except locally.

HABITAT. Fields, thickets, and, less often, open woods usually in the vicinity of water. Well-drained and sandy soils seem preferred, although it occasionally burrows in compact and heavy soils.

NOTES. We found runs of this mole common in the Piedmont of York County, the Triassic Lowlands of Adams County, and along the bases of the South Mountains and the Pigeon Hills. Less sign was seen on the shale lands in the Cumberland Valley in Franklin County. One specimen was taken along the Juniata River in Perry County, one mile west of Amity Hall.

The runways of this mole are generally larger in diameter than those of the hairy-tailed mole. Although the eastern mole occasionally pushes out small mounds of dirt, nowhere did we observe it to make the many and conspicuous mounds characteristic of the hairy-tailed mole.

In the part of our section where this mole is common, it is fairly general in distribution, but appears less abundant than the hairy-tailed

mole in western Pennsylvania. Undisturbed grassy areas near water appear to be optimum habitat. Open grassy woods on sandy flood plains often have good populations. Abandoned runs of this mole were used by meadow mice, prairie deer mice, house mice, pine mice, and, in one locality, by spotted salamanders *(Ambystoma maculatum)*.

One stomach which has been analyzed contained earthworms, insects of four orders, and a snail.

REPRODUCTIVE DATA

Date	*Embyros*	*Size*	*Scars*	*Remarks*
March 26, 1949	4	7 mm	—	—
April 8, 1949	1	—	—	Left horn partly eaten

SPECIMENS TAKEN. 8—Adams 1, Franklin 3, York 3, Perry 1.

HAIRY-TAILED MOLE

Parascalops breweri

DISTRIBUTION. Probably in all Ridge and Valley Counties. In the south of our sector we took it as far east as Everett, Bedford County, along the Raystown Branch in its gap at Tussey Mountain. In the north of our sector we took it as far east as the Barrens, near Pennsylvania Furnace, Huntingdon County.

HABITAT. Sandy soils, in forests or nearby grassy and brushy areas; often near streams, but possibly on dry mountains.

NOTES. Brewer's mole (hairy-tailed mole) in this sector is not an abundant mammal as it is in much of western Pennsylvania. Many areas in this sector appear to have no mole runs, or only those of the star-nosed mole. Sandy alluvium near streams, particularly in mountain gaps, and sandy areas near rock outcrops, either of sandstone or sandy limestone, often have runs similar in appearance to work of Brewer's mole. Heavier agricultural soils of the valleys appear devoid of them. Mole runs, that resemble those of the hairy-tailed mole, are occasionally found in the sandy soil of mountain tops as far east as Tuscarora Mountain. Barn owls usually catch this mole if it is present. In Butler County, owls took 31 Brewer's moles and an equal number of star-nosed moles among 2480 animals caught (Richmond and Roslund, 1949). Its absence from owl pellets from Letterkenny Ordnance Depot, Franklin County, representing 2302 mammals, probably indicates the absence of this species from the farmland of the Cumberland Valley. We saw no sign of it south and east of this section, although it has been taken in the Blue Ridge Province, which includes our South Mountain Section, in southern Virginia (Handley and Patton, 1947).

A stomach examined by us contained earthworms, beetles, ants, a snail, and a fibrous root. Another stomach contained only earthworms.

We took two molting specimens, one each on May 11 and September 30th.

SPECIMENS TAKEN. 5—Bedford 2, Huntingdon 3.

STAR-NOSED MOLE

Condylura cristata cristata

DISTRIBUTION. Occurs in all counties.

HABITAT. Usually grassy to forested areas with moist to saturated soil.

NOTES. This appears to be the most common mole of most of the Ridge and Valley Section here, and perhaps the only mole in certain areas of it. This species, too, is often taken by barn owls, but it was not taken by those on Letterkenny Ordnance Depot, although plenty of wet swales occur there. We took it along the west flank of South Mountain about ten miles away. It is probably somewhat local in distribution throughout the southeastern counties.

Runs of the star-nosed mole are easily found about almost any spring drain or wet bottomland. Often they follow the bottom of damp roadside ditches. In dense vegetation many surface runways can be found. This species is not nearly so particular as other moles about patching breaks in its runways, and so can easily be caught with a mouse trap. Although they are most often found in mucky and heavy soils, we found them in saturated sand below a spring at the foot of the Pigeon Hills in Adams County. A local resident informed us that he had killed two of these moles in recent years on the dry crest of Big Mountain on the Fulton-Franklin county line. In a rocky area there dominated by chestnut oak, we found mole runs through pure white sand. No water was anywhere near, nor was any moist soil. The residents' description of the mole as "the one with the hand on its nose" leaves little doubt that *Condylura* was being described.

A stomach contained beetle and fly larvae, including larvae of the crane fly *(Tipulidae)*.

REPRODUCTIVE DATA

Date	*Embryos*	*Size*	*Scars*	*Remarks*
April 13, 1949	—	—	3	—
April 14, 1949	—	—	?	Lactating
May 3, 1949	5	24 mm	—	—
May 6, 1949	4	1 mm	—	—
May 12, 1949	4	18 mm	—	Lactating
May 31, 1950	—	—	6	Scars recent

SPECIMENS TAKEN. 27—Adams 3, Bedford 8, Franklin 1, Fulton 3, Huntingdon 4, Juniata 1, Mifflin 1, Perry 2, York 4.

MASKED SHREW

Sorex cinereus cinereus

and

Sorex cinereus fontinalis

DISTRIBUTION. The masked shrew probably occurs in all counties. In addition to our records, Dr. P. F. English showed us a specimen which came from Huntingdon County and is now in the collection

at Pennsylvania State College.

HABITAT. Forests and grassy areas in this sector.

NOTES. Dr. Doutt has referred most of our skins to the subspecies *cinereus;* a few to the subspecies *fontinalis.* The *fontinalis* were distributed along several of the traplines where we took *cinereus,* and any attempt to show ecological or geographic segregation between the two forms in this area from our specimens is impossible. We suppose that the interpretation consistent with present day customs of mammal taxonomy is that our entire sector is an area of intergradation with a population tending toward *cinereus,* but with an occasional individual referable to *fontinalis.*

From our observations, habitat preference of the masked shrew in this sector is a confused picture. In much of western Pennsylvania, optimum habitat for both the masked and smoky shrew *(fumeus)* appears to be cool, moist, rocky forests, often with hemlock and birch. We found them together in such habitats in the Ridge and Valley and South Mountain sections, but scarce and locally distributed. In addition, we found the masked shrew in grassy areas and valley forest in the Ridge and Valley Section, usually in moist but sometimes in dry habitats. We never took the smoky shrew with it in such places. In southern York County we found good populations of both shrews but almost completely segregated. The smoky shrew was common in shady, moist, rocky hardwood and birch-hemlock forests along the river hillside and nearby ravines. The masked shrew was taken only once in forest in a grassy clearing, but it was found to be abundant in hot, dry, abandoned fields of broom sedge *(Andropogon virginicus)* quite different from its usual habitat in the mountains. It was also common in wetter grasslands in York County. We have seldom found it on grassy shale lands, however. In one such area in the Cumberland Valley (Letterkenny Ordnance Depot) barn owls took only two *Sorex* (species unidentified) in about 2500 individuals. These two they could have caught on North Mountain. The little short-tailed shrew, *Cryptotis* was abundant there on shale land. We found no masked shrews in the Triassic Lowlands of Adams County although *Cryptotis* was again present. In much trapping of talus slopes we never took the masked shrew. This species seems less likely to be found in rocky localities than is the smoky shrew in this sector.

In summary, this shrew appears to occupy habitats with a wide range of conditions and to be more tolerant of dry and open habitats than the smoky shrew. However, it appears to be scarce and localized in some areas of this sector and possibly absent from certain habitats.

REPRODUCTIVE DATA

Date	*Embryos*	*Size*	*Scars*	*Remarks*
May 11, 1949	5	1 mm	—	—
May 12, 1949	3	1 mm	—	—
May 13, 1949	6	1 mm	—	—
May 14, 1949	5	7 mm	—	—
April 19, 1950	4	11 mm	—	—
April 19, 1950	2	6 mm	—	—

SPECIMENS TAKEN. 55—Adams 1, Bedford 23, Franklin 7, Fulton 2, Perry 1, York 21.

GREY LONG-TAILED SHREW

Sorex dispar

DISTRIBUTION. Known only from Huntingdon and Perry Counties in this section.

HABITAT. Collected among deep-piled rocks in cool, moist, forested areas.

NOTES. Many cool, moist, and shaded rocky areas occur throughout this section as well as warmer and drier ones perhaps less suitable for this species. This fact, together with the known distribution of this shrew, makes it possible that enough trapping of such habitats would show it to be present in all of the Ridge and Valley counties. It is not known from the rock slides of South Mountain in this section, nor has it ever been reported from the Blue Ridge of Virginia. A summary of Pennsylvania localities and the habitat conditions where this shrew has been taken was reported by Richmond and Grimm (1950).

The two localities where we took this shrew are: 2 miles NE of Spruce Creek, Huntingdon County, and 5 miles SSW of New Bloomfield, Perry County.

We took this shrew associated with the smoky shrew *(Sorex fumeus)* in both localities but did not take the masked shrew *(Sorex cinereus)* with it.

SPECIMENS TAKEN. 3—Huntingdon 2, Perry 1.

SMOKY SHREW

Sorex fumeus fumeus

DISTRIBUTION. Occurs in all counties. Found by us in the Piedmont along the lower Susquehanna, on mountains of the Ridge and Valley Section, and in the South Mountains.

HABITAT. Forests in the mountains; steep, rocky, wooded stream hillsides in the southeastern lowlands.

NOTES. We have not taken the smoky shrew in valley woodlands in this sector except in steep, rocky areas near streams. In western Pennsylvania, this shrew often occurs in sandy, long-neglected fields with dense grass cover; also in thickets derived from such fields. We have not taken it in similar habitats in this section. Here it appears to prefer sandy or rocky woodlands with undisturbed soil and an accumulation of humus or leaf mold. In this region, such habitats are almost confined to mountains and the steep banks of larger streams. This shrew has been taken so often near rotting logs and stumps that we believe that they are favorable habitat factors.

The highest population of this shrew, which we saw, was in what appeared to be an atypical habitat on the wooded crest of Dunning

Mountain along the top of a dry talus slope. The ground cover consisted of a very thin accumulation of soil and leaf mold over the rocks and a dense growth of huckleberry bushes. No surface water existed anywhere near and, except for moisture deep among the rocks, the area is very dry. In six nights of trapping, this line yielded 22 *fumeus*, 4 *cinereus*, and 9 *Blarina*. Most of the *Blarina* were taken in traps set in places where there were several inches of soil, but most of the *Sorex* were taken at the edge of the talus where there was just a thin layer of leaf mold.

REPRODUCTIVE DATA

Date	*Embryos*	*Size*	*Scars*	*Remarks*
May 18, 1949	6	1 mm	—	—
May 25, 1949	5	12 mm	—	—
May 26, 1949	5	less than 1 mm	—	—
May 27, 1949	6	9 mm	—	—
June 30, 1949	6	5 mm	—	—
March 31, 1950	5	2 mm	—	—
April 13, 1950	5	3 mm	—	—
April 14, 1950	4	1 mm	—	—
May 5, 1950	4	4 mm	—	—
May 10, 1950	5	10 mm	—	—

SPECIMENS TAKEN. 84—Adams 6, Bedford 25, Blair 8, Cumberland 1, Franklin 4, Fulton 1, Huntingdon 17, Mifflin 2, Perry 2.

WATER SHREW

Sorex palustris albibarbis

DISTRIBUTION. Not well known in this sector. Our two specimens from Tea Creek, in the Seven Mountains region, Mifflin County, constitute the first record of this species in the Ridge and Valley Province. It has been known for some time from northeastern Pennsylvania and was taken in southwestern Pennsylvania, Somerset County, by Pittman-Robertson Project 24-R.

HABITAT. The two specimens were taken in a cool, mountainous region.

NOTES. The above description of Tea Creek applies to a number of other small streams in the Seven Mountains region. The following streams in this section that appear to be equally suitable are: Bob's Creek, and tributaries in Bedford and Blair Counties; Laurel Creek in Perry County; and headwaters of Aughwick Creek in Allen's Valley, Fulton County. Wolf and Wishart "swamps" in Bedford and Fulton Counties are isolated, but possible, habitats.

The one stomach examined contained only small fragments of unidentified chitin.

SPECIMENS TAKEN. 2—Mifflin 2.

SMALL SHORT-TAILED SHREW

Cryptotis parva parva

DISTRIBUTION. Not well known for this sector. We found it only in Franklin and Adams Counties. It was reliably reported to us from Fulton County.

HABITAT. Grassy and weedy areas, both wet and dry. Has never been taken in forest in this state.

NOTES: Available literature, trapping experience, and talks with other collectors seem to indicate that this shrew exists in highly localized colonies in much of Pennsylvania. Unless he should happen on such a colony, a collector is likely to leave an area without it, although owls may take it in the same region. We found one such colony on Martinsburg shale land at Letterkenny Ordnance Depot. Two skulls from a bottle, found on one of our traplines, comprise our only records from the Triassic Lowlands of Adams County. An observing farmer in Fulton County described to us two of these shrews which he found under a lime pile in a winter wheat field on Catskill shale lands there. This tiny, short-tailed shrew has been taken only in, and around, fields in Pennsylvania, some low and moist, others elevated and dry. Much of the shale land through this area with thin, stony soil and sparse cover would seem to offer conditions more suitable for *Cryptotis* than *Blarina* which is usually comparatively scarce in these places.

A female taken November 29, 1949, in Franklin County, had one four millimeter embryo and another specimen of the same date had two uterine scars.

SPECIMENS TAKEN. 29——Franklin 27, Adams 2.

SHORT-TAILED SHREW

Blarina brevicauda brevicauda

DISTRIBUTION. Common in all counties.

HABITAT. May, at times, occur in all habitats. The optimum habitat has either friable soil or dense cover on the surface of the ground in the form of leaves or matted vegetation.

NOTES. As elsewhere in Pennsylvania, *Blarina* is one of the three most abundant mammals. However, it does not occur here in the extremely high densities that have been observed in much of western Pennsylvania. Two extensive habitats in this section normally have very few *Blarina*. One of these is the dry ridges where the thin clay soil is not suitable for burrows and the oak forest produces little or no leaf litter. The other habitat consists of open fields on thin, shaley soils. These fields support a sparse cover of grasses and weeds with bare ground exposed between the plants. In both habitats, the limiting factor appears to be the lack of surface litter. In 116 localities trapped

during our summer work, we caught no *Blarina* in 26, and the maximum number taken in any one locality was 27. In five lots of Barn Owl pellets from Letterkenny Ordnance Depot, Franklin County, *Blarina* comprised only 2 per cent of the 2320 mammals eaten as compared to 21 per cent of the 2480 mammals eaten by Barn Owls in Butler County (Richmond and Roslund 1949). In general, all habitats in this section had a lower population of *Blarina* than similar habitats in western Pennsylvania.

One *Blarina* and two *Peromyscus* were found in the stomach contents of a copperhead *(Agkistrodon mokasen)*.

REPRODUCTIVE DATA. Of 29 pregnant specimens examined, 22 were trapped in March, April and May; 3 were taken in June; and one each in August, September and October. Litter size ranged from 2 to 7, with 6 being most frequent.

SPECIMENS TAKEN. 520—Adams 36, Bedford 120, Blair 10, Cumberland 6, Franklin 55, Fulton 100, Huntingdon 72, Juniata 13, Mifflin 34, Perry 14, York 60.

BATS

In our work we examined no caves for bats. The following information concerning the cave-inhabiting species is from Mohr (1931, 1932) who has examined most of the caves in this section and reported on the fauna of them. The turnpike tunnels referred to were the long-abandoned railroad tunnels that later were completed for the Pennsylvania Turnpike. With the completion of the highway, these tunnels no longer serve as bat roosts, but the same species of bats should still occur in the area as there are numerous caves throughout this section.

SMALL BROWN BAT. *Myotis lucifugus lucifugus*

This species is the bat that most often roosts in attics of houses, sometimes in colonies of several hundred bats.

SPECIMENS TAKEN. 7—Huntingdon 6, Perry 1.

RECORDS SEEN. Bedford, Franklin, Fulton, Mifflin. No doubt occurs in all counties.

KEEN BAT. *Myotis keenii septentrionalis*

RECORDS SEEN. "Common everywhere about caves in summer, but is quite rare in winter, being encountered most frequently in caves east of the Allegheny Mountains" (Mohr, 1932). No doubt occurs in all counties.

SOCIAL BAT. *Myotis sodalis*

RECORDS SEEN. Bedford (Hipple Cave and turnpike tunnels), Franklin and Fulton (turnpike tunnels), Mifflin (Aitkin Cave). Has never been taken southeast of Blue Mountain Tunnel in Franklin County.

LEIB BAT. *Myotis subulatus leibii*

RECORDS SEEN. "Rarest and smallest of eastern bats" (Mohr, 1932). Mifflin County (Aitkin Cave).

GEORGIA PIGMY BAT. *Pipistrellus subflavus subflavus*

SPECIMENS TAKEN. 1—Huntingdon 1.

RECORDS SEEN. Franklin, Fulton, Bedford, in turnpike tunnels. "Most common of cave bats" (Mohr, 1932). Probably occurs in all counties.

NEW YORK PIGMY BAT. *Pipistrellus subflavus obscurus*

RECORDS SEEN. None. Probably occurs in our sector since it has been recorded due north and southwest of it.

LARGE BROWN BAT. *Eptesicus fuscus fuscus*

This bat, like the small brown bat, often roosts in houses and is frequently seen flying in the vicinity of buildings.

SPECIMENS TAKEN. 1—Huntingdon 1.

OBSERVATIONS. Huntingdon, Mifflin.

RECORDS. Blair. "Common in all parts of the state" (Mohr, 1931)

EVENING BAT. *Nycticeius humeralis*

RECORDS SEEN. Carlisle, Cumberland County (Rhoads, 1903) citing G. S. Miller, Jr. Apparently has not been taken since in our sector; is probably rare and local, if still present.

RED BAT. *Lasiurus borealis*

SPECIMENS TAKEN. 1—Fulton County 1.

OBSERVATIONS. Occasionally seen by us in all parts of our sector.

HOARY BAT. *Lasiurus cinereus*

RECORDS SEEN. No definite records for our sector. Has been recorded on all sides of our sector, and is known to be resident in our latitude east and west of us. Possible resident here; very probably occurs as a migrant.

SILVER-HAIRED BAT. *Lasionycteris noctivagans*

RECORDS SEEN. Numerous in all parts of the state where he had shot bats, according to Rhoads. No definite record for our sector has been seen. Records from all sides of our sector exist, however, and it probably occurs here, at least as a migrant.

NON-GAME RODENTS

CHIPMUNK

Tamias striatus lysteri

DISTRIBUTION. Occurs in all counties.

HABITAT. Forest, forest edge; extending into open farm land only where suitable cover is available along fence rows, stone piles or rock ledges.

NOTES. We found chipmunks scarce and local during our work in this sector, except on Spruce Creek in Huntingdon County where a fair general population existed. Since residents everywhere are quite familiar with the animal we can only suppose that this scarcity is probably a temporary fluctuation. Chipmunk populations are often highly localized and apparently similar habitats a few miles apart may differ greatly in the number of chipmunks present.

Favorable chipmunk habitat usually includes: good visibility at ground level; plenty of elevations such as rocks, stumps, logs or old fences for feeding posts, sunning, observation posts, elevated runways, and concealment. Burrows are most often dug under some substantial cover rather than in open ground. Chipmunks also require a reliable, abundant source of food, such as trees or shrubs that bear seeds dependably.

Chipmunks occur in forest, both farm woodlot and mountain forest. We have found them in wooded areas of large stone blocks and around the edges of talus slopes, but not well out into the barren talus area as we have woodrats. Chipmunks also live in brushy areas such as cutovers, scrub oak thickets, roadsides, streamside banks, rocky banks, and brushy waste areas around farms. A single tree in a close-cropped pasture is enough cover for a chipmunk if it provides seeds for food. They appear not to depend on close concealing cover such as dense grasses or weeds, and in fact rather avoid such areas. Chipmunk populations are more likely to be found in areas where the ground is open and visibility is good. They depend much on sight for protection and climb up on logs, rocks, stumps, roots, rail fences, and other elevations to feed, sun themselves, and keep a lookout. Their feeding posts on such elevations are easily recognized by cut seeds and insect remains. Mice and shrews usually carry their food under cover to eat. Chipmunks are careful to hide the entrance to their burrow and much prefer to dig them under an overhanging rock or root, under a log, stump, building, rail fence, stone pile or stone fence. Occasionally, but rarely, we have seen them dug in short grass, or leaf ground cover, without any overhead concealment or protection. Dirt is not found thrown out around their den entrances which are consequently most inconspicuous.

Chipmunks eat insects, mushrooms, and sometimes carrion. Farmers have told us that they sometimes pull sprouting corn along field edges. They also feed to some extent on some of the numerous small and tender

seeds, but their principal food appears to be the larger dry or hard-shelled seeds which probably have better storing qualities. In looking for chipmunks, the presence and abundance of such food sources should be considered, as good chipmunk populations seem always related to them. Acorns are eaten by chipmunks, but for some reason extensive oak woodlands do not dependably support large chipmunk populations throughout. Areas with abundance and variety of seed bearing shrubs, whether in forest or farmland, are optimum for chipmunks. Such shrubby areas include roadsides through woodland, steep banks, ledges or cliffs, and waste areas about farms, including abandoned pastures. Wild cherry seeds appear to be one of the foods most used and the presence of these trees, or of hickory, wild grape, hazel-nut, dogwood, or spice bush appear necessary. That chipmunks tend to locate a good source of dependable food and colonize there is shown by the fact that roadside dumps, picnic grounds, and camps, in or near woods, often have a population of chipmunks when they are seldom seen elsewhere in the area.

Chipmunks are most easily observed in the late summer and fall when juveniles are more abundant and when the animals are active in collecting seeds for storage. During the spring and early summer, when most of the young are born, chipmunks are more quiet and wary and are often hard to locate. A whistling chirp, a sort of birdlike warning note given just before they dive into their burrows often reveals their presence when they are hard to see. On wet, foggy, or rainy mornings, a mid-morning sun will often bring the chipmunk population out to dry and sun themselves, and such mornings are among the best times to look for them. We have seldom seen them active in the late afternoon. We have never seen them active in the evening hours as squirrels often are.

SPECIMENS TAKEN. 21—Adams 4, Bedford 1, Franklin 1, Fulton 2, Huntingdon 7, Juniata 2, Mifflin 2, Perry 2.

SOUTHERN FLYING SQUIRREL

Glaucomys volans volans

DISTRIBUTION. Occurs in all counties.

HABITAT. Forests and woodlots throughout this sector.

NOTES. We found flying squirrels locally common in hardwood forests as well as in mixed forest dominated by hemlock. Favorable conditions appear to include mast-bearing trees such as mature oaks, hickories, hemlocks, and the presence of vines and dead trees, such as chestnuts, with woodpecker holes. We have never taken flying squirrels from homogeneous open stands of big timber. We doubt if they are ever common there. The best locations we found have always had small trees or vines and thick overhead cover.

The larger northern flying squirrel *(Glaucomys sabrinus)* is known from several localities in the northern counties of Pennsylvania. The

nearest locality to this sector from which we have a record is McGee's Mills, Clearfield County, reported by Pittman-Robertson Project 37-R. The northern flying squirrel has never been recorded from the Ridge and Valley Section and we did not find it. It is possible, however, that it may extend into this sector. The localities that have apparently suitable habitats are: Allegheny Mountain in Blair and Bedford Counties, the Seven Mountain region in Mifflin County, and from there to the vicinity of Spruce Creek, Huntingdon County.

REPRODUCTIVE DATA

Date	*Embryos*	*Size*	*Scars*	*Remarks*
March 27, 1949	—	—	5	Lactating
April 4, 1949	—	—	3	Lactating
August 18, 1949	—	—	2	—
August 20, 1949	—	—	2	—
April 1, 1950	3	4 mm	—	—
April 6, 1950	2	2 mm	—	—

SPECIMENS TAKEN. 20—Adams 1, Franklin 1, Huntingdon 2, Mifflin 8, Perry 2, York 6.

CLOUDLAND DEER MOUSE

Peromyscus maniculatus nubiterrae

DISTRIBUTION. Known only from Bedford, Huntingdon and Mifflin Counties in this sector. Should occur in Blair County and may occur locally on mountains throughout the Ridge and Valley Section.

HABITAT. Taken in cool, moist, rocky mountain forest in this sector, usually with much hemlock, and often with yellow birch, striped maple, and rhododendron. We have also taken it well out among the rocks of a talus slope near the crest of Dunning Mountain.

NOTES. Here, as in southwestern Pennsylvania, this mouse is not always present in stands of the forest association mentioned. Such habitats in this sector are more numerous in the north. They usually occupy steep, shaded slopes and stream ravines near the foot of mountains or moist, elevated benches and rock slides along their north slopes, rather than the mountain sides and crests in general. Some trapping of hemlock and black birch forest, and much trapping of talus slopes and mountaintop in the southern and eastern mountains of this sector, failed to find the cloudland deer mouse. Its exact distribution, and the habitat conditions associated with it, remain an interesting problem in this area.

Two anatomical differences were observed that are useful in distinguishing fresh or live specimens of the two forms of *P. maniculatus* from the more common white-footed mouse *(P. leucopus)*. In both forms of *maniculatus*, the tail is fleshier and tapers gradually and evenly from base to tip. In *leucopus*, the tail is usually thinner throughout its

length and tapers abruptly towards the tip, giving it an acuminate appearance. The other difference observed is in the size of the eyes of the two species. Both forms of *maniculatus* have smaller eyes than *leucopus*. The eye ball of *leucopus* is approximately 1 millimeter larger in diameter than that of *maniculatus*. This results in *leucopus* having a characteristically big-eyed appearance. The two forms of *maniculatus* are not likely to be confused since *maniculatus nubiterrae*, the cloudland deer mouse, is the largest of the three white-footed mice and has a very long tail. The prairie deer mouse *(maniculatus bairdii)* is the smallest of the three and has a conspicuously short tail.

Wherever the cloudland deer mouse occurs in south central Pennsylvania, it appears in company with the common white-footed mouse.

SPECIMENS TAKEN. 28—Bedford 20, Huntingdon 4, Mifflin 4.

PRAIRIE DEER MOUSE

Peromyscus maniculatus bairdii

DISTRIBUTION. Probably occurs in all counties. Taken in the Piedmont of southern York County within 22 miles of the Coastal Plain.

HABITAT. Grassy and weedy areas, usually with thin herbaceous cover and much bare ground.

NOTES. We have taken them in fallow weedy fields; margins of cornfields; bare, stony roadsides with scattered weeds and grasses; and a few areas of thicker grass, probably abandoned pasture. They also occurred in open grassy areas of the Huntingdon County Barrens near Pennsylvania Furnace. A definite tendency to follow these habitat conditions along roadsides and right-of-ways seems apparent. In the South Mountains, we found *bairdii* living along a pipe line right-of-way where it passed through a cool hemlock forest.

Where woods or brush are nearby, the white-footed mouse often occurs in the same habitat with *bairdii*. In southern York County, we found high populations of both the prairie deer mouse and the house mouse *(Mus)* in the same dry, weedy fallow field. Usually it has few close neighbors. An occasional meadow mouse or short-tailed shrew may occur with it. On a pipe line right-ofway through forest land, we took *bairdii* in company with smoky shrews. In Franklin County, where it was common, it was found with the little short tailed shrew, *Cryptotis*.

Twenty-five specimens of the prairie deer mouse were collected three miles north of Delta, York County. This locality is the farthest east that they have been found. It is three miles from Maryland and only twenty-two miles from the Atlantic Coastal Plain. This is forty-seven miles southeast of Harrisburg, Pennsylvania, where Hamilton (1950) reported their occurrence.

In addition to starchy material, we have found the remains of a small salamander and insect chitin in the stomachs we examined.

Our data seem to indicate a breeding season almost, or entirely, throughout the year. We have collected pregnant individuals from April to December, and the size of some juveniles caught in April indicates the possibility of year-round breeding.

SPECIMENS TAKEN. 122—Adams 2, Bedford 7, Franklin 80, Huntingdon 3, Mifflin 4, Perry 1, York 25.

WHITE-FOOTED MOUSE

Peromyscus leucopus noveboracensis

DISTRIBUTION. Common in all counties.

HABITAT. Found in almost every mammal habitat and at all elevations in the region.

NOTES. Probably more numerous and successful than any other small mammal in our sector. It occupies almost every wooded and brushy area, and is occasionally present, and sometimes abundant, in grassy and weedy places. It follows edges of crop fields and occupies shocked corn in fields. It is successful in dry forests deficient in ground cover, and it is sometimes more numerous in such areas than in nearby cool, moist, shady forest with more ground cover and variety of vegetation. Favorable conditions appear to include abundant tree and shrub seeds, especially the larger and better-lasting kinds, such as acorns, nuts, and the stony seeds of many fruits. The stomachs of these mice usually contain starchy material and often chitin from insects or other vertebrates. The highest populations we have encountered have been in areas with a local abundance of acorns. Areas with only small "soft-shelled" seeds such as birch, maple, or weed-seeds usually have small populations. In extensive areas of scrub pine, or oak and scrub pine on very thin shaley soils almost lacking ground cover, this species appears to be the only really successful mouse-sized mammal, and it seems rather thinly distributed in such places. It ranges well out into open talus slopes in some places, but seems usually more numerous along the wooded edges.

SPECIMENS TAKEN. 884—Adams 13, Bedford 97, Blair 37, Cumberland 7, Franklin 90, Fulton 174, Huntingdon 111, Juniata 24, Mifflin 151, Perry 51, York 129.

ALLEGHENY WOOD RAT

Neotoma magister

DISTRIBUTION. Occurs in all counties.

HABITAT. Cliffs, caves, areas of large stone blocks, and talus slopes on and near the mountains of our area.

NOTES. In addition to counties where we took it, Rhoads records it from Cumberland, Juniata, and York Counties, the latter erroneously (Mohr, 1931, pp. 93-94). A hasty search for sign in a rocky area along the lower Susquehanna in York County was fruitless, but it may well exist there. We saw some sign near High Rock in the Pigeon Hills in York County near the Adams County line.

Every mountain talus slope and block area examined by us held wood rats. We also found them in hills, where there was suitable habitat several miles from the main ridges. Since rocky areas are so widespread here, the wood rat is a common and characteristic mammal of this sector. It is usually more abundant near the shrubby and wooded edges of talus slopes, but if a few black birches have managed to establish themselves well out among the rocks, the wood rat can exist there. It appears little limited by the nature of the vegetation or by the kind of stone in this area. The only limiting factor observed was the availability of rocky habitats.

On the mountains, we found them among birches and hemlocks on cool, moist, sandstone talus slopes, and in drier areas with oaks and pitch pine. Near Spruce Creek, a warmer area of sweet soil, dolomite blocks, and young forest of black ash, slippery elm, butternut, and locust had a thriving colony.

Stomachs which we examined during the summer were filled principally with green leaves. Bark is also much eaten, but many twigs are cut and piled about their nests and runways so that all species cut may not be used for food. Striped maple, mountain maple, black birch, purple-flowering raspberry, and red-berried elder are characteristic plants on sour talus slopes of Tuscarora Quartzite, especially in the north of our area. These species we observed to be cut frequently.

We have taken wood rats which were molting during May and August. Juveniles were taken in June and August.

SPECIMENS TAKEN. 17—Bedford 2, Franklin 3, Fulton 1, Huntingdon 7, Mifflin 3, Perry 1.

STONE'S LEMMING MOUSE

Synaptomys cooperi stonei

DISTRIBUTION. Very probably occurs in all counties of the Ridge and Valley Section, and in Franklin and Cumberland Counties along their western borders. We have no records east and south of Blue Mountain in this sector.

HABITAT. Abandoned fields reverting to brush and grass, and weedy burned areas in forest are common habitats.

NOTES. The distribution of this vole in south central Pennsylvania is interesting, as it apparently does not occur in the Cumberland Valley or south and east of the Valley. North and west of Blue Mountain it occurs both in the valleys and on the mountains. This mouse may occur in the South Mountains of Franklin County where there is much suitable habitat. Because, during the summer of 1950 all microtine rodents were so scarce in the South Mountains, our negative results there do not preclude the possibility of its occurrence. Further evidence that it does not occur in the Cumberland Valley is the absence of this species in the diet of the barn owls on Letterkenny Ordnance Depot.

The habitat preferences of the lemming mouse are hard to define although with practice some ability to recognize suitable habitats is acquired. The largest habitat they occupy is abandoned fields on infertile, acid soils. These characteristically have a thin to dense cover of poverty grass *(Danthonia)* with scattered patches of various woody plants, briars, shrubs, and young trees. In such fields, the lemming mice may be generally distributed but more often are localized around the margins of the field or in the shrubby patches out in the field. Often the lemming mouse is the most abundant rodent in old fields. In addition to the old field habitat, these mice occur in a wide variety of more or less isolated habitats, such as grassy clearings in forests, seepage areas around springs, grassy thickets, grassy and weedy cut-overs, and burns in forests.

In general, the lemming mouse does not occur with either the pine mouse or the meadow mouse. When all three species are in a locality, they tend to occupy different habitats or different parts of the same habitat. This is apparent in the trapping results of three trap lines that yielded *Synaytomys* and at least one other microtine:

Trapline No.	63	65	71
Synaptomys	28	3	1
Microtus	15	34	0
Pitymys	3	0	6
Peromyscus leucopus	21	1	7
Blarina	24	4	5
Sorex cinereus	1	0	0
Condylura	1	1	0
Mus	0	1	0

Apparently this species may breed throughout the year. A large population trapped in Fulton County during October, 1949 had many pregnant females as well as juveniles of all sizes.

REPRODUCTIVE DATA

Date	*Embryos*	*Size*	*Scars*
May 19, 1949	6	7 mm	—
Oct. 1, 1949	3	8 mm	—
Oct. 20, 1949	—	—	5
Oct. 20, 1949	3	10 mm	—
Oct. 21, 1949	4	15 mm	—
Oct. 21, 1949	5	10 mm	—
Oct. 23, 1949	4	22 mm	—
Oct. 23, 1949	3	9 mm	—
Oct. 24, 1949	4	6 mm	—
Oct. 27, 1949	3	1 mm	—
Oct. 29, 1949	—	—	6
Oct. 29, 1949	3	14 mm	—
Nov. 8, 1949	—	—	3
Dec. 11, 1949	3	26 mm	—
July 8, 1950	3	3 mm	—
July 9, 1949	—	—	6
Aug. 16, 1950	2	5 mm	—

SPECIMENS TAKEN. 53—Bedford 8, Fulton 39, Huntingdon 2, Perry 4.

RED-BACKED MOUSE

Clethrionomys gapperi gapperi

DISTRIBUTION. Occurs in all counties with the possible exception of York County.

HABITAT. Cool, moist, rocky, forested areas on or near the mountains in this sector.

NOTES. The red-backed mouse was found only in forests, and only in such forests as afforded cool, moist retreats among rocks. Such areas occur principally on the mountains in this section and along steep, rocky stream banks, especially those with north exposures. It appears that the presence of such cool, moist retreats is the limiting factor in their distribution here. They are not limited by forest type, although such habitats on sandstones usually have a characteristic acid-soil vegetation with birches and hemlocks among the dominant trees. We also found these mice in rocky areas of limestone and dolomite with very different vegetation at Spruce Creek. We found none in a mature stand of hemlocks, birch, and rhododendron on the flood plain of Bob's Creek where no stone labyrinths occur. We have never taken it in woods regrown from fields, nor in pastured woodlots. We failed to find red-backs in rocky ravines with black birch and hemlock along the lower Susquehanna in York County.

Stomachs of red-backed mice examined by us contained starchy as well as green material. In one place, a dense population appeared to be feeding on abundant scrub oak acorns and to some extent on the leaves of scrub oak seedlings. Ferns, usually *Dryopteris*, were seen cut and occasionally leaves of birch seedlings.

REPRODUCTIVE DATA

Date	*Embryos*	*Size*	*Scars*	*Remarks*
May 5, 1949	—	—	4	Lactating
May 5, 1949	—	—	6	—
May 5, 1949	4	5 mm	—	Lactating
May 5, 1949	4	9 mm	—	—
May 5, 1949	—	—	6	Lactating
May 5, 1949	—	—	4	Lactating
May 17, 1949	4	13 mm	—	—
May 17, 1949	5	5 mm	—	—
May 17, 1949	5	under 1 mm	—	—
May 17, 1949	4	17 mm	—	Lactating
May 17, 1949	4	5 mm	—	Lactating
May 17, 1949	4	2 mm	—	—
May 17, 1949	4	5 mm	—	Lactating
May 17, 1949	4	9 mm	—	Lactating
May 17, 1949	3	23 mm	—	—

Date	*Embryos*	*Size*	*Scars*	*Remarks*
May 18, 1949	5	7 mm	—	Lactating
May 18, 1949	8	5 mm	—	Lactating
May 19, 1949	4	12 mm	—	—
June 28, 1949	—	—	4	—
Aug. 10, 1949	—	—	4	—
May 4, 1950	3	11 mm	—	—
May 9, 1950	4	1 mm	—	—
May 13, 1950	—	—	4	—
Aug. 3, 1950	—	—	2	—
Aug. 6, 1950	—	—	4	—

SPECIMENS TAKEN. 147—Adams 3, Bedford 79, Blair 3, Franklin 8, Fulton 3, Huntingdon 30, Mifflin 18, Perry 3.

PENNSYLVANIA MEADOW MOUSE

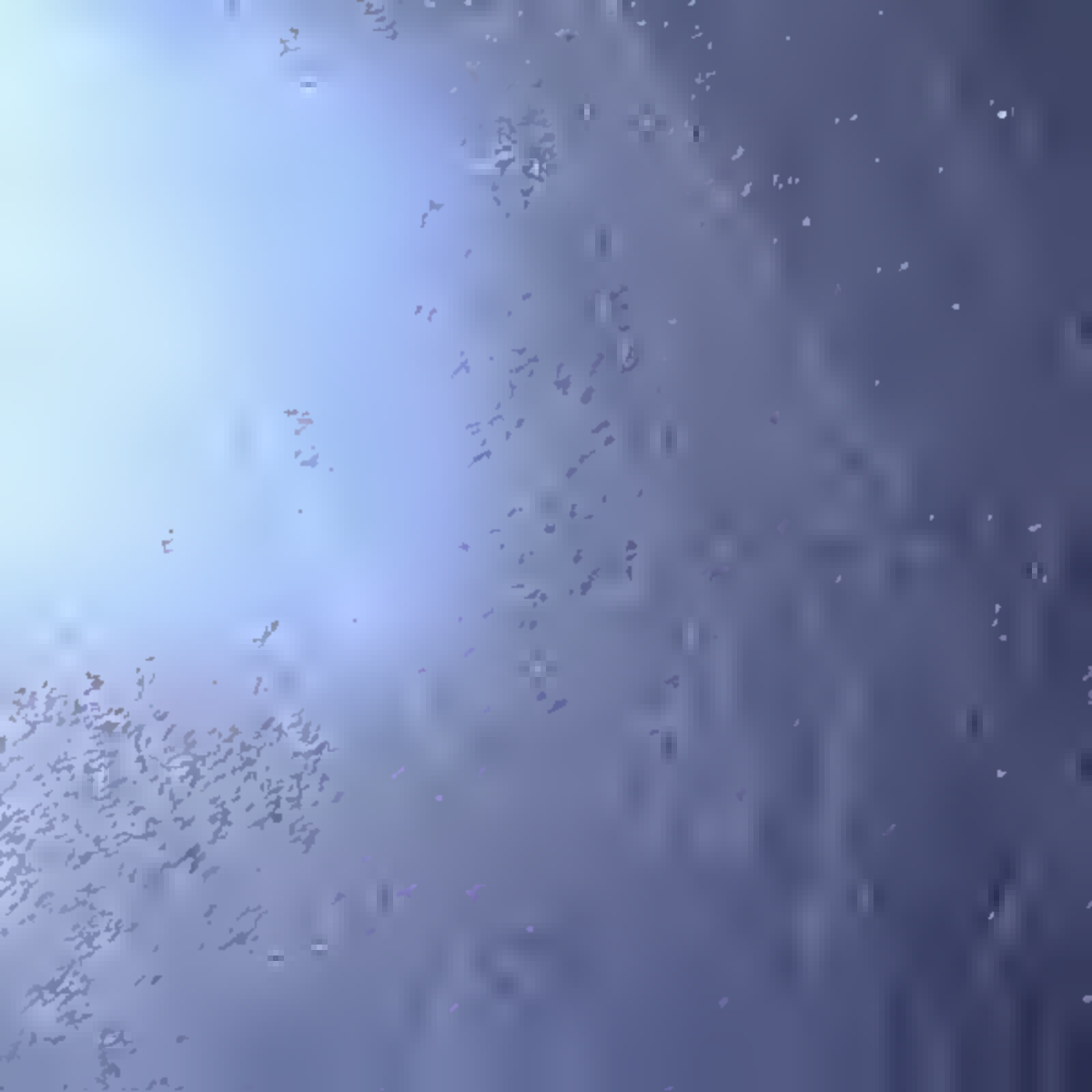
Microtus pennsylvanicus pennsylvanicus

DISTRIBUTION. Common in all counties.

HABITAT. Wet or dry, grassy, weedy, sedgy, and rushy areas, with thick or thin herbaceous cover. Borders of grain fields and shocked grains; probably also inhabits the standing grain here to some extent.

NOTES. As elsewhere in the state, the meadow mouse is one of the three most abundant small mammals, widely distributed in almost all of the grassy habitats created by man. However, we rarely encountered good general populations here comparable to those we have seen in several parts of western Pennsylvania. Much of the area in the central part of this sector is occupied by dry, stony soils which do not produce so thick and uniform a grass cover as is common in western Pennsylvania. It is possible that these areas seldom, or never, carry high populations of meadow mice. Moister, or more fertile, soils usually have good cover and often a fair meadow mouse population. We often found little uniformity in the populations within working range of one field headquarters—similar suitable habitats within a few miles having a good population, another a low population. The best populations seen were on the most fertile soils.

The most abundant sign seen over a large area was during the spring of 1950 in southern York County, where a good number appeared to have overwintered. Here runs were common and meadow mice were easily trapped in numbers. Some girdling of young locust trees in fencerows, under cover of Japanese honeysuckle, was seen. This and the cutting of honeysuckle tips appeared to be the work of meadow mice. In western Pennsylvania, girdling of locust trees was observed during a meadow mouse high. The girdling of black locust and black cherry, as revealed in the spring, is a practical and convenient indication of areas that had a high winter population of meadow mice.



Meadow mice may breed throughout the year. We have collected pregnant mice from March 31 to November 27. In 87 pregnant mice examined, litter size ranged from 2 to 8; 5 was the most frequent number and 66 of the 87 had litters of 4 to 6.

SPECIMENS TAKEN. 594—Adams 36, Bedford 77, Cumberland 29, Franklin 163, Fulton 99, Huntingdon 22, Mifflin 26, Perry 28, York 114.

PINE MOUSE

Pitymys pinetorum scalopsoides

DISTRIBUTION. Occurs in all counties.

HABITAT. Occurs here in both woods and fields and in thickets and fencerows. Appears to favor the lighter soils, but also occurs in heavier soils.

NOTES. We found good populations of this mouse in only a few places, but it is probably more common than our specimen list would indicate. Because it burrows more than the meadow mouse and makes fewer and less conspicuous surface runways, sign of individuals, or colonies, is more likely to be overlooked. For the same reason, it is less likely to be trapped accidentally. Special effort was often necessary to obtain a specimen from a certain area. It appeared to us that in no part of our sector was the pine mouse as common as the meadow mouse during our work there. Ordinarily we took only one or a few individuals in a locality, and usually saw no signs of well-populated colonies or of a widespread population. In southern York County, however, we found evidence of fairly good colonies of pine mice in friable soils along the Susquehanna, and in thickets, fencerows, and old fields. These signs seemed to indicate a general population. In Franklin and southern Fulton Counties, pine mice appeared widely, but rather thinly, distributed.

The habitat preferences of the pine mouse in this sector are far from clear. In general, it seems to be found in a wider range of habitat types than in western Pennsylvania. There, sandy or alluvial soils along wooded streams seem to be optimum habitat, and it is almost entirely a woodland species. We seldom found it in forest here. In the Ridge and Valley Section we found it most often on loose, or sandy, soils in long-abandoned grassy areas well on their way to becoming forest again. In the southeastern counties, it appeared in similar places and about the edges of agricultural land, in fencerows and grassy areas not yet grown up in thickets, and occasionally on heavy soils. We have never taken it in the cool, moist mountain-ravine forests or on talus slopes in our area in company with red-backed mice. The few forests where we took it were warm, dry, hardwoods. It seems most abundant in those regions of our sector where oaks are dominant and hickory and wild grape are common in the forest. We have taken them

in the edges of cornfields, but observed no evidence that they inhabit fields of small grain. We never saw them about hayfields or pastures in use, as we did the meadow mouse.

Where leaves or needles of trees are beginning to replace grass as ground cover, this matted layer forms a roof for their runways. Such places are among the best spots to look for pine mice. These tunnels resemble those of the short-tailed shrew and are about the same width, but usually are round in cross-section rather than flattened. Frequently those of the pine mouse are more cleanly cut and often contain food cuttings of grasses or other stems. Occasionally the pine mouse makes surface runs through dense, or even through thin, grass cover. These resemble, in size and general organization, the runs of the lemming mouse. They are narrower and less well-worn than those of the meadow mouse and go underground more often in a short distance. Most grass cuttings appear to be carried underground rather than strewn about the surface runs as those of lemming mice often are.

Runs of pine mice are usually found in well-drained soil, occasionally in springy soil. We have never found them in muddy, marshy, areas of intermittent water level or standing water, such as are commonly inhabited by meadow mice. We have often found these two species living in close proximity, but there appeared always to be two colonies, side by side, and mingling at the edges rather than mingling indiscriminately. We found pine mice more closely associated with lemming mice in a few places.

On April 6, 1950, a nest of a pine mouse was discovered in a grassy forest under a discarded piece of carpet. The nest was composed of grasses and fibers from the carpet, all very finely chewed. It resembled a slightly flattened sphere, about the size of a large grapefruit, and had only one entrance. It was inhabited by a rather small male pine mouse.

In the runways of pine mice we have found cuttings of grasses, principally *Poa* species, sedge (*Carex* Sp.) and parts of violet and ground ivy *(Nepeta)*. We examined stomachs which contained both green vegetation and starchy material, more often the former. Sometimes white, fibrous material resembling basal parts of grass stems were found. In a few cases pokeberries had been eaten until the abdominal muscles and skin of the animal were stained with them. In one case, acorns had been eaten. Pine mice fed heavily on wild onion when present, especially in winter and early spring. At such times their flesh smelled strongly of the onion.

In the orchard section of the Cumberland Valley, the pine mouse causes considerable damage by feeding on the roots of apple trees. In south central Pennsylvania it is this species, rather than the meadow mouse *(Microtus)*, that causes the most orchard damage, and the use of poisons has been found necessary for control.

REPRODUCTIVE DATA

Date	*Embryos*	*Size*	*Scars*	*Remarks*
March 31, 1949	2	—	—	Newly implanted
August 30, 1949	2	10 mm	—	—
April 20, 1950	2	13 mm	—	—

SPECIMENS TAKEN. 48—Adams 1, Bedford 2, Cumberland 2, Franklin 9, Fulton 12, Huntingdon 1, Juniata 1, Perry 5, York 15.

HOUSE MOUSE

Mus musculus musculus

DISTRIBUTION. Occurs in all counties, but was more abundant in fields in the southern counties.

HABITAT. Man's dwellings, storehouses, and stock shelters; grain fields, in the shocked grain. Occurs in a feral state where grass, weed, or sedge seeds are abundant, including weedy cornfields and roadsides. Occasionally found in forest, well removed from farms and homes.

NOTES. House mice have been caught as occasional feral individuals along roadsides in other parts of Pennsylvania. We caught a few in such places in this sector. Probably roadsides, with their abundant weed seeds, are common habitats, or travel routes, for house mice. On abandoned farmland in Franklin County, fifteen feral individuals were caught in one field, but we took none in other fields there. Two very high populations were found in fields elsewhere in this sector. One was possibly a local high, the other probably represented a widespread high in the area.

The highest feral house mouse population we have seen in Pennsylvania was discovered in Fulton County. Eighty individuals were trapped there. Of these, fifty-seven were caught in a few acres in a line of fifty traps in six nights' trapping. This line ran along the grassy creekside edge of a field of shocked corn, very weedy with foxtail grass, which was showering seed in abundance on the ground. This appeared to be the main food source. Corn was present in the shocks, but seemed little bothered by the mice. Foxtail grass is an abundant cornfield weed in southern Fulton County. Perhaps other cornfields had similar house mouse populations, but we did not trap them. The population described was about three-fifths juveniles and two-fifths adults. About half the females were pregnant and the other half recently had been. Litter size ranged from two to eight, with an average of almost six.

House mice were not confined to cornfields in southern Fulton County. We took them in many grassy habitats, some long-abandoned and a mile or more from the nearest inhabited farm. In two cases, a single specimen was taken in mountain forests separated by two miles of forest from the nearest farm.

The largest male house mouse taken in Fulton County weighed 24 grams. This specimen was as heavy as a good-sized adult male white-footed mouse.

In southern York County, a weedy field supported high populations of both house mice and prairie deer mice. It is interesting to note that here two species about the same size, and with similar habits, were living in the same field, intermingling, neither excluding the other.

SPECIMENS TAKEN. 131—Cumberland 3, Franklin 14, Fulton 80, Perry 1, York 43.

NORWAY RAT

Rattus norvegicus

DISTRIBUTION. Occurs in all counties.

HABITAT. Man's buildings and dumps. Common along streams in settled and agricultural areas. Frequents shocked grain and fencerows near human habitation.

NOTES. The role of the Norway rat as a pest in cities, towns, and about farms is too well known to bear repeating here. Its success as a feral animal, unassociated with man, has been less often investigated. We saw rat tracks along a number of rivers and creeks in the area. From the observations here, and elsewhere, we believe they are a common part of the fauna along many larger streams, even those well removed from towns. We took two on top of Town Hill Mountain under a garage. The three buildings there are isolated by about a half mile of forested mountain traversed by a highway. We have known them to occur in isolated dumps, but at three such dumps on wooded mountainside in Fulton County, we found no sign of them. Deer mice, chipmunks, skunks, and opossums frequented and inhabited these dumps.

The only truly feral Norway rat we took was caught at the base of an oak-forested hillside in a jumble of stone blocks. This appeared to be suitable habitat for woodrats. This was in the ravine of a small tributary to Muddy Creek, in southern York County, about 200 yards from the creek and at least half a mile from the nearest house. Muddy Creek's shore here also had a large population of rats.

Past experience has shown how destructive this mammal can be. The possibility that it may be learning to adapt itself to an independent existence, and may become increasingly successful in numerous wildlife habitats, is worthy of intensive investigation.

Although the black rat, *Rattus rattus rattus*, and the roof rat, *Rattus rattus alexandrinus*, have been found in isolated localities in Pennsylvania, we have seen no recent records and have no information on them in this sector.

SPECIMENS TAKEN. 7—Cumberland 1, Fulton 2, Huntingdon 3, York 1.

MEADOW JUMPING MOUSE

Zapus hudsonius hudsonius

DISTRIBUTION. Occurs in all counties.

HABITAT. Undisturbed grassy and weedy areas; sometimes grassy thickets and open woods, often near water.

NOTES. Wet sedge meadows, alder thickets, and weedy flood plains, open or wooded, in cooler parts of our sector appear to be the

preferred habitat of *Zapus*. Less often they were taken in dry, weedy, abandoned fields farther from water. We got the impression that, in the south and east of this area, they are more local in distribution and more closely associated with moist or shady habitats.

REPRODUCTIVE DATA

Date	*Embryos*	*Size*	*Remarks*
May 12, 1949	5	2 mm	—
June 8, 1950	7	5 mm	—

The southeastern jumping mouse, *Zapus hudsonius americanus*, is known from southeastern Pennsylvania, and may occur in York County.

SPECIMENS TAKEN. 16—Adams 1, Bedford 2, Cumberland 2, Fulton 4, Huntingdon 6, Perry 1.

WOODLAND JUMPING MOUSE

Napaeozapus insignis insignis

DISTRIBUTION. May occur along the mountains throughout the Ridge and Valley Section and possibly in the South Mountain Section.

HABITAT. Cool, shady margins of mountain streams, usually in forests with birches and hemlocks. Occasionally in grassy thickets near cold streams, and in cool shady forests such as steep northern exposures along larger streams near the mountains.

NOTES. Suitable-appearing habitat for the woodland jumping mouse exists in every county in our sector with the possible exception of York County. A number of such habitats yielded us no specimens however, and we took this mouse only on the western and northern borders of our sector. Perhaps it occurs more widely, but is either presently scarce or always highly localized. We did not find it limited to rocky woodland as we did the red-backed mouse, nor was it limited to a sour-soil mountain flora. In a steep, rocky woods below a dolomite cliff with rich soil and vegetation atypical of the mountain ravines, we found both jumping mice and red-backed mice.

Although green herbaceous plants were common where we found these mice, the stomachs we examined contained principally starchy material and blackberries.

REPRODUCTIVE DATA

Date	*Embryos*	*Size*	*Scars*	*Remarks*
May 8, 1949	4	1 mm	—	—
May 9, 1949	6	2 mm	—	—
June 9, 1949	—	—	4	Lactating
June 10, 1949	—	—	5	Lactating
July 2, 1949	—	—	5	—
August 4, 1949	5	5 mm	—	—

SPECIMENS TAKEN. 20—Bedford 7, Blair 2, Huntingdon 6, Mifflin 5.

PORCUPINE

Erethizon dorsatum dorsatum

DISTRIBUTION. The exact present distribution of porcupines in this sector is not known. It has been reported to us as being present in recent years in Adams, Blair, Bedford, Franklin, Fulton, Huntingdon, Mifflin and Perry Counties.

HABITAT. Probably occurs in this sector only on forested mountain tops or in extensively forested mountain valleys. Reports indicate that here, as elsewhere in the state, porcupines prefer areas with a good amount of white pine and hemlock and rocky places for dens. Areas well removed from much human activity should support porcupines better since these animals are easily killed by man.

NOTES. Rhoads had few records of the porcupine from this sector. It probably was scarce, and locally distributed, here in his day. It may have never been common here in historic times since this appears to be at or near the southeastern limit of its range. Rhoads mentions the porcupine in this sector as follows:

Fulton County—Sideling Hill Mountain near Locust Grove, 1878.

Huntingdon County—Entriken, 1898; not known near Mt. Union, 1896.

Juniata County—Blacklog Mountain, 1897.

Franklin County—near Upper Strasbourg, 1897; not known in the South Mountains, 1896.

He gives records from Cambria, Somerset or Centre Counties to the north and west of our sector.

There is some evidence that the porcupine has been increasing in numbers and extending its range in recent years. Since it is still highly localized in south central Pennsylvania, a detailed list of the localities where it is now known to occur is included here. Porcupines were reported to us as follows:

Adams County—Carbaugh Run in the South Mountains just east of Caledonia State Park, 1947; Mr. James Sheperd, Fayetteville, R. D. 1 reported quills in a dog.

Bedford County—head of Bob's Creek on Game Land #26 near Blue Knob; 2 trapped in the last seven years by District Game Protector Jack DeLong. Sweetroot Gap and Bear Gap near Bean's Cove in rocky stands of virgin hemlock, 1918; reported by District Game Protector Orrie Smith. Dunning Mountain south of St. Clairsville; reported by an unidentified hunter in recent years.

Blair County—Bob's Creek locality cited above is on the Blair-Bedford County line.

Allegheny Mountain west of Tyrone about 1948 by an unidentified hunter.

Fulton County—Ray's Hill Mountain just south U. S. Route 30; twenty pound specimen caught by Mr. William Markle, Breezewood, R. D., March 1949.
Gusty Hank's farm about 2 miles east of Breezewood; specimen killed by Mr. William Markle about 1945.

Huntingdon—occurs on Jack's Mountain as far south as Mt. Union according to District Game Protector George Smith.
Occurs near Mt. Union and, according to an unidentified coon hunter, it was reported from the general vicinity of Shade Gap.

Mifflin—junction of Broad and Stone Mountains, on crest about 3 miles WSW of Milroy; District Game Protector George Smith reported having seen barked trees 1948.
Jack's Mountain in Mann Narrows; Mr. Curtis Stricker, Yeagertown, caught two specimens 1948.

Perry—Bower's Mountain; Mr. Carl Schlusser, Echo Grove Restaurant, saw sign several years ago.

We ourselves found porcupine sign in the following localities:

Adams—Small tributary of Carbaugh Run near, or identical to, Mr. Sheperd's locality.

Franklin—Chimney Rocks, near Mont Alto Sanatorium in the South Mountains.

Huntingdon—Greenwood Tower on Broad Mountain.

Mifflin—junction of Broad and Stone Mountains near, or identical to, Mr. Smith's locality.

Porcupines probably are occasionally brought into this sector from the north by hunters and later released. Some of our records may be of such animals. Particularly is this likely to be true of our records from the South Mountain, since it is isolated from porcupine range to the north by the Cumberland Valley. Porcupines were unknown in the South Mountains in the time of Rhoads. Most residents of the region believe that they have never existed there and do not now.

Because of the porcupine's frequent habit of living in very rocky areas and tending to range close to its den, it is possible for an animal this large to exist in an area and not be known to local people. However, coon hunters usually know if there are porcupines in an area through having to remove quills from their dogs.

CHANGES IN MAMMALIAN POPULATIONS

Our studies of two winters in Letterkenny Ordnance Depot, Franklin County, suggest no material change in the rabbit population there during that time (1948-49, 1949-50). An examination of the records of the number of rabbits removed from the depot since 1943 seems to indicate a sharp rise starting in 1946, reaching a peak in 1947-48, and declining the next year to the level existing before the peak.

We saw no evidence of a change in small mammal populations during our two winters, with the possible exception of increase in the little short-

tailed shrew *(Cryptotis)*. Our higher catch of these in 1949-50 may have been caused by the discovery of a local colony missed the year before. Elsewhere in our sector, we found most of the mouse-sized mammals only fairly common, often scarce, and the few high populations quite local.

With a number of the larger species, such as squirrels, rabbits, and groundhogs, we found a strong tendency to vary locally in abundance. Considering the amount of local variation in conditions in this sector, this is not surprising.

We got the impression from talking with trappers that the increase of fox populations in recent years was not as marked here as in western Pennsylvania. We also got the impression that foxes may have decreased in the past year or two in several areas. The recent high mink population of western Pennsylvania seems not to have occurred here. Muskrats were said by some trappers to have decreased locally in western parts of our sector. They attribute this decrease to hard trapping. Raccoons, opossums, and skunks seemed almost everywhere common to abundant, and this appears to represent an increase over a number of years. Many rabbit hunters believed that rabbits were more plentiful in their localities during 1949-50 than they had been in the years immediately previous. In some localities, farmers believed that groundhogs had been increasing for several years.

DATA AND REPORTS

The original data, field notes, and specimens on which this report is based have been deposited in the Section of Mammals, Carnegie Museum, Pittsburgh, Pennsylvania.

This report was prepared by Clay L. Gifford, Project Leader, and Ralph Whitebread, Assistant Project Leader. It was edited and abstracted by Neil D. Richmond, Project Field Supervisor.

CONCLUSIONS AND RECOMMENDATIONS

Although much of the information obtained from this type of survey is of greatest value as reference material for those who are dealing with specific wildlife problems in this area, either now or in the future, certain of the information obtained suggests specific recommendations:

1. The suggestion of Richmond and Roslund (1949) for liming of of right-of-ways through forested, acid soil areas applies equally well in this section, particularly in the Ridge and Valley and South Mountain Sections where the soils are most deficient in lime and where localization of rabbits and groundhogs is most noticeable.
2. The largest area of undisturbed habitat in south-central Pennsylvania is in the forested mountain ridges with an additional large

area in the scrub oak "barrens" of Huntingdon County and the shale barrens of southern Bedford and Fulton Counties. Due to the peculiarities of the topography, the ridges of the Ridge and Valley Section and most of the barrens are practically deserts in so far as surface water is concerned. In many areas the available water is in the valley below, separated from the forest by farms. It is recommended that sources of available surface water be developed on these dry ridges by construction of small impoundments and catchment basins or by improving existing springs. This would seem to be especially desirable in those areas that are at present State Game Lands and State Forests.

3. The fertile Cumberland Valley is potentially the best farm game area in south-central Pennsylvania. The principal limitation to the realization of this potential is the lack of suitable cover for game species. Well distributed throughout this farmland are numerous rocky outcrops, steep streamsides, erosion gulleys, and small swales that would produce abundant cover and game if they were protected from grazing. In most cases, these small waste areas are pastured, not because of the forage they produce, but because it is not economically feasible for the farmer to construct a fence around them. Cooperation with the landowner on the part of the Pennsylvania Game Commission and/or organized sportsmens' groups could result in the fencing of these retreat areas.

4. Since the largest area of productive farm game cover in Pennsylvania is composed of abandoned farms and neglected fields, it is recommended that a study be made of the characteristic plant succession that takes place in the first ten to twenty years of land abandonment. A number of studies have been made of the changes in woody plants from the brush stage to mature forest, but we lack information on the changes in the composition and density of the herbaceous plants and grasses. Such information should explain the phenomena often observed where land abandonment is first followed by a marked increase in farm game species only to be, in turn, followed by a gradual decline to a low level of productivity. Our observations indicate that these changes are not the same in all parts of the state, but apparently vary with the type of soil, and take place more rapidly on infertile soils.

5. It is recommended that a continuing study be made (if only an annual examination) of the plant and animal changes that are taking place on Letterkenny Ordnance Depot.

6. Throughout the Cumberland Valley in Cumberland and Franklin counties there are local colonies of a very large native fox squirrel. Wherever it occurs, it is considered a prize by squirrel hunters. It is recommended that a management study of this squirrel be undertaken with the object of increasing their numbers, and, if possible, introducing them in other areas in south-central and southeastern Pennsylvania.

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